ABSTRACT

BAKKEN, JOHN ROBERT. The Impact of Institutional Characteristics on Performance Measure Success Rates at Community Colleges in North Carolina. (Under the direction of Dr. M. Jayne Fleener).

The North Carolina Community System is comprised of 58 unique community colleges created with the express purpose of serving their local communities, ranging from large urban areas to small rural coastal and mountain areas. Community colleges adapt to serve their unique communities' needs, which is one of their defining strengths, yet the differences among colleges calls into question the use of a one-size-fits-all comparison of institutions. The current system of standard performance measures for North Carolina Community Colleges provides a snapshot of the quality of community colleges across the state but fails to account for the varying needs served by each school's programs and services.

This research focuses on the definition and construction of the performance measures as well as potential biases hidden by how the performance data are calculated and reported. Analyzing the construction of performance measures may lead to a more fair, meaningful, and useful approach to understanding student success measures for community colleges. This research is grounded in principal-agent theory and assumes the need to develop performance measures to control the actions of the institutions they fund and provide accountability to their public. The purpose of this study is to examine the relationships between institutional characteristics and the current North Carolina Community College Performance Measures. Through the principal-agent framework, institutional characteristics serve as a proxy for community need. This research identified whether the actions of the principal to control the agent are impacted by the agent's choices to serve their community. More simply stated, this study explores whether the construction of the North Carolina Community College System

Performance Measures provides an equitable measure of performance and whether institutional characteristics impact a college's ability to meet performance standards.

Statistical analysis is completed on institutional characteristic variables and NC community college performance measures using Kruskal-Wallis, Mann-Whitney U, and Kendall's τ_b tests. These tests show a statistically significant (minimum $p < 0.05$) impact on community college success measures from 10 institutional characteristics. Additional testing of kurtosis and skewness along with a Shapiro-Wilk test show that the data for three of the performance measures do not come from a normal distribution, which has a direct impact on how baseline performance levels are determined. Addressing such biases using readily-available institutional characteristics in future assessments will provide the opportunity to develop performance measures that better represent each community college in the system and provide a more accurate picture of each institution's effectiveness within its own community.

The Impact of Institutional Characteristics on Performance Measure Success Rates at
Community Colleges in North Carolina

by
John Robert Bakken

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APPROVED BY:

_____   _____
Dr. M. Jayne Fleener   Dr. Duane Akroyd
Committee Chair

_____   _____
Dr. Susan Barcinas   Dr. Chad Hoggan

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DEDICATION

This dissertation is dedicated to community college students. I hope this work can contribute, in some small way, to getting you as far as you can go.

BIOGRAPHY

John Bakken was born in San Antonio, Texas, to a military family. Following high school, he attended Armstrong Atlantic State University (now the Armstrong campus of Georgia Southern University) graduating with a Bachelor of Science in Mathematics with a minor in Computer Science. John then proceeded to study at The University of North Carolina at Chapel Hill where he earned a Master of Science in Mathematics.

After earning his master's degree, John began working for Wake Technical Community College in Raleigh, North Carolina, as a Mathematics instructor. John progressed to administrative roles within the department serving as a lead online instructor and Associate Department Head before leaving the classroom. Currently he serves as the Dean of Curriculum Support providing data analyses and project oversight for campus-wide projects.

ACKNOWLEDGMENTS

I could not have done this without the support of my wife Melinda. The English language does not have words to describe what you mean to me.

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Introduction

The North Carolina Community College System was established by General Statute

§115A in 1963 (North Carolina Community College System [NCCCS], 2008; Quinterno, 2008)

as a department within the State Board of Education. In 1981, the department separated from the

State Board of Education becoming a separate board with the mission of providing oversight to

the system of community colleges within the state of North Carolina. Driving goals in the

creation of the NCCCS were to make a system that was open-door and to ensure that every state

resident would live within approximately 30 miles of a community college (Wiggs, 1989).

Today, after tremendous growth during the latter part of the 20th century, the system has

plateaued, with 58 community colleges, some having a student population that rivals the size of

four-year institutions in the state (Quinterno, 2008).

There are several layers of oversight for each of the 58 community colleges in the

NCCCS that support coherence and consistency that have allowed the system to flourish and

grow. For example, the unified oversight by the State Board of Community Colleges has

provided a mechanism for strategic expansion, while the NC Community College Combined

Course Library allows for seamless transfer of credits between community colleges. The system

has also benefited students with the creation of the NC Comprehensive Articulation Agreement,

creating policies for the transfer of course credit from any community college to a four-year

public institution within the state. Another advantage to the State Board governance structure is

that it leverages political influence and advocacy for the system, as a whole. A primary

responsibility of the board and the system president is to communicate needs and leverage their

influence to obtain public resources from the legislature and other public resource agencies.

In addition to the oversight provided by the State Board and State Legislature, a third layer of organizing oversite occurs at the campus level in the form of a Board of Trustees. Campus-level Boards of Trustees are appointed at each Community College in the system. The local board, by NC General Statute §115D-12, consists of a minimum of 12 appointed members who must be residents of the college's service area or a neighboring county. The Governor of North Carolina appoints four trustees, as do the County Commissioners of the counties served by the community college, and the local Board of Education in the college's service area. An additional ex-officio non-voting member of the board of trustees is a student representative from the college's student government.

Figure 1.1 represents the complexity of the NCCCS governance system. The governance system results in higher education institutions with three governing bodies that do not always serve the same constituents. Each college in the system was created to serve a specific community and has specific service areas with unique citizen populations (Quinterno, 2008). To serve the students of their communities, each college tries to meet the needs and expectations of a different population while adhering to the same set of state-wide mandates. This makes for 58 community colleges that are each trying to achieve the same overarching goals in different manners, for different populations, and with different definitions of success. The result is an environment where it is difficult to determine if a community college is successful at its mission.
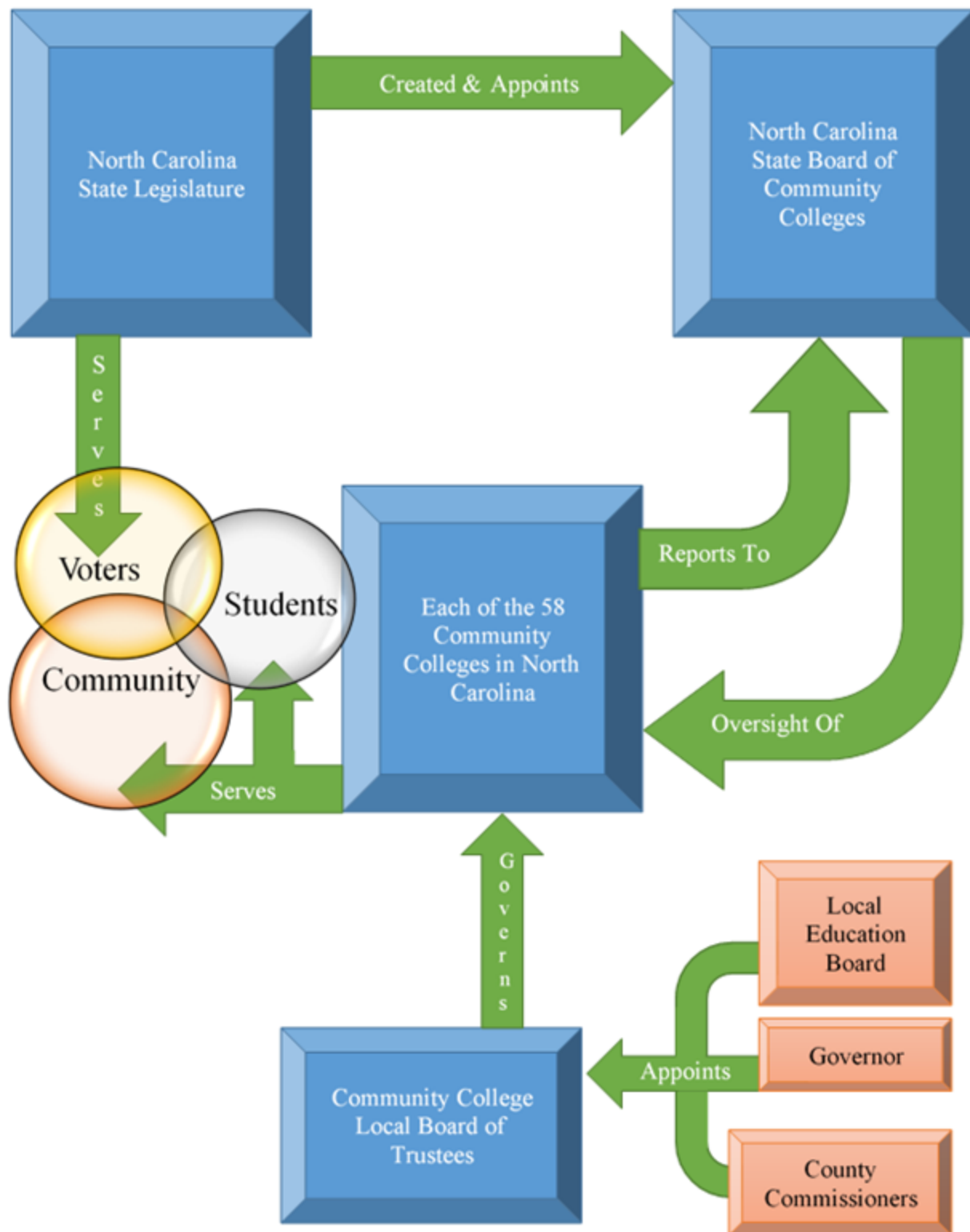
Figure 1.1. Connections between state agencies and community colleges in North Carolina that begin to inform the conceptual framework

Background of the Problem

With the wide range of interested parties, it has become difficult to define community college success (let alone do so fairly), although governments and colleges across the United States have been trying for decades (Bailey, 2012; Burke & Serban, 1998; Cook & Pullaro, 2010; Harbour, 2002; Layzell, 1999). There is little data used across the country that can be identified as a standard for performance of a college. The U. S. Department of Education, National Center for Educational Statistics, Integrated Postsecondary Education Data System (IPEDS) is one repository of data collected on community colleges. But until recently, the data focused on first-time, full-time students, making the data not representative of community college students (Burke, 1998; Gross, 2013; Mullin, 2012). As one example, Wake Technical Community College reported 5,991 new (non-continuing) degree/certificate-seeking students in the Fall of 2017 (IPEDS, 2017). Of the 5,991 students, only 1,843 (approximately 30.8%) are first-time, full-time students. This leaves 4,148 part-time and transfer students, approximately 69.2% of the Fall 2017 new students, unaccounted for in measures that use a first-time, full-time cohort as the basis for college and/or student success metrics.

Despite the difficulty in defining success, the U. S. Department of Education and the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) acknowledge the importance of measuring success at the national level. SACSCOC accredits each of the community colleges in NC (United States Department of Education Database of Accredited Postsecondary Institutions and Programs, 2019), which the Department of Education requires for an institution to be eligible to award financial aid to low-income students in the form of Pell grants. The SACSCOC (2017) accreditation requirements are the listed in following standards:

- 7.1 – The institution engages in ongoing comprehensive and integrated research-based planning and evaluation processes that (a) focus on institutional quality and effectiveness and (b) incorporate systematic review of institutional goals and outcomes consistent with its mission;

- 8.1 – The institution identifies, evaluates, and publishes goals and outcomes for student achievement appropriate to the institution's mission, the nature of the students it serves, and the kinds of programs offered. The institution uses multiple measures to document student success; and

- 8.2 – The institution identifies expected outcomes, assesses the extent to which it achieves these outcomes, and provides evidence of seeking improvement based on analysis of the results in the areas below:

    o Student learning outcomes for each of its educational programs

    o Student learning outcomes for collegiate-level general education competencies of its undergraduate degree programs.

SACSCOC wrote the accreditation requirements in a way that does not require that specific measures be the same for each accredited institution. Instead, each institution can craft their own measures of performance that specifically address the needs of their students, while still showing that the self-identified measures are used to seek improvement.

Research also indicates that the greatest benefit from assessing performance is found when the measures acknowledge the diverse goals of students attending community colleges, which are by definition institutions designed to serve local needs and constituents (Bailey, 2012; Bragg & Durham, 2012; Burke, 1998; Burns, 2010; Hill, 2004; Matsudaira, 2016; Mullin, 2012). According to Ireland (2015), students' racial and socioeconomic backgrounds had an impact on

the success of community colleges. Ireland's research also shows that disaggregated assessment provides important information that allows for intervention and practices that meet the needs of subpopulations of students whose needs may not have been obvious in aggregate. This means the performance of community colleges can, and should, be assessed by measures that carefully take into account the specific needs of the communities and students served by the community college.

The governing bodies of community colleges in NC have not ignored the need to measure the performance of community colleges. In 1998, the NC General Assembly enacted North Carolina General Statute § 115D-31.3, creating the state performance measures for community colleges. The statute states:

> *The State Board of Community Colleges shall adopt and implement a system of*
> *accountability measures and performance standards for the Community College System.*
> *At least once every three years, the State Board of Community Colleges shall review, and*
> *revise if necessary, the accountability measures and performance standards to ensure*
> *that they are appropriate for use in recognition of successful institutional performance. If*
> *the State Board determines that accountability measures and performance standards*
> *must be revised following a review required by this subsection, the State Board shall*
> *report to the Joint Legislative Education Oversight Committee prior to the*
> *implementation of any proposed revisions.*

This law established 12 performance measures (see Table 1.1) for the NCCCS. Fully implemented in 2001 (Harbour & Nagy, 2005), the law also established a financial incentive for five of the 12 performance measures and allowed for each community college president to choose a 6th measure eligible for financial incentive.

Table 1.1.

Initial Performance Measures Established by NC GS § 115D-31.3

Eligible for Incentive Funding	Additional Measures
Progress of basic skills students	Success rates in developmental courses
Passing rate for licensure and certification examinations	Success rates of developmental students in subsequent college-level courses
Goal completion of program completers and non-completers	The level of satisfaction of students who complete programs and those who do not complete programs
Employment status of graduates	Curriculum student retention and graduation
Performance of students who transfer to the university system	Employer satisfaction with customized training
	Program Enrollment[a]

[a] Program enrollment was enacted by NC GS § 115D-31.3(e) as amended and could not be selected as the 6th measure for incentive funding.

In 2010, the NCCCS established a review process (NCCCS, 2019a) to re-examine the Performance Measures established by North Carolina General Statute §115D-31.3. The review process resulted in recommendations for deletions, additions, and changes to the performance measures. The NC State Board of Community Colleges approved the most recent performance measures in 2018. The current system has seven measures as shown in Table 1.2. The Licensure and Certification Passing Rate measure uses a weighted scale, with select licensures counting more toward the measure. The other six measures evaluate the binary student values of successful or not successful to calculate the proportion of students that meet the requirement for each measure.

Table 1.2.

2019 North Carolina Performance Measures (NCCCS, 2019a)

Measure	Cohort Year	Number of Students	System Average	Baseline	Excellence	Standard Deviation
Basic Skills Student Progress	2017 – 2018	58,509	39.9%	24.2%	50.6%	8.80%
Student Success Rate in College-Level English Courses	Fall 2015	39,195*	61.7%	40.1%	66.6%	8.83%
Student Success Rate in College-Level Math Courses	Fall 2015	39,195*	41.5%	19.5%	46.2%	8.90%
First Year Progression	Fall 2017	52,521*	67.2%	56.6%	71.9%	5.10%
Curriculum Student Completion	Fall 2014	47,978*	47.6%	34.1%	52.7%	6.20%
College Transfer Performance	2016 – 2017	17,214*	85.9%	74.4%	89.4%	5.00%
Licensure and Certification Passing Rate	2017 – 2018	19,512	1.00	0.79	1.07	0.09

Note. The number of students represents the sum of students at each of the 58 community colleges and not the system total.

For each measure, the population of study will vary each year due to the time needed for completion of each measure, which varies from one to four years. Each measure is accompanied by an excellence level and a baseline level. Both excellence and baseline values are determined using data from the previous three years. The excellence level is determined as one standard deviation above the system average. The baseline level is determined as two standard deviations below the system average. The use of performance levels one and two standard deviations away from the mean brings up mathematical concerns with the construction of the NC community college performance measures. For example, measures exist in which the level of excellence is below 50% success and this procedure works under the assumption that a college will fall below the baseline. A detailed discussion of the challenges associated with the current performance measures as they are calculated in the NCCCS using standard deviations can be found in Appendix A. These challenges suggest a need to revisit how excellence is measured in the community college system and, in particular, how to allocate resources to meet the needs of students based on meaningful assessment results and local needs.

Statement of the Problem

The current system of performance measures for NC community colleges provides a snapshot of the quality of community colleges across the state. While funding is provided in association with the state performance measures, the $3 million provided for each measure is small in comparison to each college's annual budget and is not a focus for this research. The focus of this research is on the definition and construction of the measures and potential biases hidden by how the data are calculated and reported. While reporting benchmarks themselves is problematic as described in Appendix A, construction of system-wide quality measures inadvertently leads to inequities that disadvantage particular institutions because of size,

population, or individual mission. Analyzing the construction of performance measures, beyond

how the results are reported (as described in Appendix A), may enlighten a more fair,

meaningful, and useful approach to understanding student success measures for community

colleges.

The first statistical challenge that may create systematic inequities is how performance

measures are calculated under the assumption of data normality. Normality is assumed in setting

the performance measures' excellence and baseline levels, and the assumption that data are

normally distributed impacts other aspects of measure construction.

Assumption of normality. Typically, standard deviation is a reliable measure when data

are normally distributed. In the case of the performance measures selected, the data adhere to

three specific properties:

- each measure has a fixed number of students;

- the success of each student is independent, meaning that the success of any given

  student is not changed by the success of any other student; and

- there are only two possible outcomes for each student, successful or unsuccessful.

Satisfying the above properties shows that the performance measure data follow a binomial

distribution. As a binomial distribution, standard deviation does not always provide the same

level of information as might be commonly expected. As shown in Table 1.3, the use of a normal

distribution versus a binomial distribution results in the mean changing by anywhere from 0.01

percentage points to 1.92 percentage points. The use of a normal distribution impacts four of the

six measures, and a total of 16 colleges (28%), with one college impacted on two measures,

raising the question about the impact of using a normal distribution to compare colleges and

calculate success benchmarks in the NC community college performance measures.

Table 1.3.

Differences in Mean using Binomial and Normal Distribution for North Carolina Community College System Performance Measures

Performance Measure	Mean using Binomial Distribution	Mean using Normal Distribution	Change in Mean	Colleges Changing Performance Level
Basic Skills Student Progress	39.9%	41.82 %	-1.92%	5
Student Success Rate in College-Level English Courses	61.7%	60.99%	0.71%	2
Student Success Rate in College-Level Math Courses	41.5%	41.49%	0.01%	0
First Year Progression	67.2%	68.25%	-1.05%	0
Curriculum Student Completion	47.6%	49.29%	-1.69%	6
College Transfer Performance	85.9%	85.17%	0.73%	4

Note. Licensure and certification pass rate is not included as it does not follow a binomial distribution.

Beyond the choice of distribution (binomial versus normal), the use of the normal distribution presents additional concerns. The normal distribution behaves in very specific ways, one of which is approximated by the Empirical Rule, which states that approximately 68% of data will be within 1-standard deviation of the mean, and approximately 95% of data will be within 2-standard deviations of the mean. The empirical rule is demonstrated in Figure 1.2.
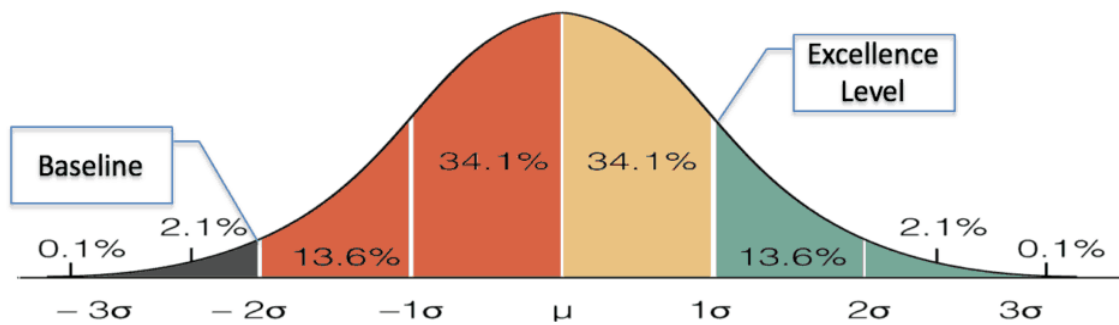
Figure 1.2. The normal distribution curve applied to performance levels in the North Carolina Community College System (Granados, 2019)

This creates a situation where approximately 2.2% of colleges (1 college) would be classified as below the baseline level, 47.7% of colleges (28 colleges) will be classified as above the baseline but below the system average, 34.1% of colleges (20 colleges) will be classified as above the system average but below the excellence level, and 15.8% of colleges (9 colleges) will be classified as above the excellence level. Even when colleges do manage to improve their performance on one of the measures, the target measures are recalculated every three years. Colleges can improve their performance level only to find that the baseline or excellence level has moved, and some colleges may find changing their relative ranking to be virtually impossible. This creates a second challenge to the design of the NC community college performance measures by calculating benchmark scores through the use of mean calculations and using normal distribution assumptions.

The performance measures do not address college size in their calculations either. For example, Isothermal Community College had 393 students represented for the Basic Skills Progress performance measure in the 2019 report (NCCCS, 2019a). With 123 of the students in the Basic Skills Progress measure demonstrating a measurable skills gain, Isothermal Community College showed that 31.3% of their students were successful in the Basic Skills Progress measure. This placed Isothermal Community College above the baseline but below the system average for this measure. In the same report, Central Piedmont Community College had 5,328 students represented for the Basic Skills Progress measure. Of the Central Piedmont basic skills students, 1,802 students demonstrating a measurable skills gain, representing 33.8% of their students. This performance level also placed Central Piedmont Community College above the baseline but below the system average. The role of size comes into play when considering the number of students needed to increase performance on this, or any other measure. For a 1% gain

in the Basic Skills Progress measure, Isothermal Community College must increase the performance for 40 students. At Central Piedmont Community College, the same 1% increase in performance requires 533 students to increase their performance. Central Piedmont Community College requires 13 times more students to increase their performance on the basic skills progress. The large difference between colleges represents a design issue the performance measures do not address, namely that larger institutions are disadvantaged in their attempts to improve relative performance. The case of Isothermal and Central Piedmont Community Colleges is just one example that shows how the current determination of baseline and excellence levels calls into question how the performance measures define success. With the definition of baseline and excellence levels set by the NC community college performance measures, the State Board of Community Colleges is effectively comparing institutions to each other across the state.

One additional design feature that may unfairly advantage or disadvantage institutions based on the assumption of normality is how excellence levels are calculated. The design uses comparative values of success which creates a system where a college can achieve a level of excellence with less than half of their students considered successful, as is the case with the Credit Math Success performance of Alamance Community College in the 2019 performance measures (NCCCS, 2019a). (See Appendices B and C for a full list of performance indicators by each of the 58 community colleges in NC). Alamance Community College had 46.6% of their students achieve success as measured by the Credit Math Success measure. This placed Alamance in the excellence category as they scored higher than the 46% required. With less than half of the measured students succeeding on a college-level math course within their first three years, Alamance Community College is classified as excellent in Credit Math Success.

Another set of issues occurs because community colleges are compared in a way that does not take into consideration the differences in institutional characteristics such as degree focus, gender and racial make-up, student poverty levels, and staff characteristics. Each community college in NC serves a distinct service area (Quinterno, 2008). These service areas represent distinct communities that contribute to the institutional characteristics of each community college.

Institutional characteristics. As shown above with the impact of college size on the NC community college performance measures, one may question which other institutional characteristics impact college performance. Current research suggests that characteristics such as degree focus (Hill, 2004; Mast, 2017); percentage of females enrolled (Bailey, Calcagno, Jenkins, Kienzl, & Leinbach, 2005; Hill, 2004); proportion of students receiving Pell funding (Bailey, Calcagno, Jenkins, Kienzl, & Leinbach, 2008), and proportion of part-time instructional staff (Bailey et al., 2005; Jacoby, 2006) have an impact on individual student performance. However, there is no current research on the impact of institutional characteristics on overall college performance.

Purpose of the Study

By looking at the bigger picture, one recognizes the NC system has 58 unique community colleges created with the express purpose of serving their local communities. The communities served range from large urban areas to small rural coastal and mountain areas. Some of the differences among community colleges in NC can be seen in Table 1.4, which shows the number and type of students. Table 1.5 shows additional differences in the NC community colleges, listing the types of degrees pursued and awarded, and the degree of urbanization for the community served. The differences found in Tables 1.4 and 1.5, along with many other

dissimilarities in the community colleges, highlight their ability to adapt to serve their distinct communities as one of their defining strengths, but calls into question the use of a one-size-fits-all comparison of institutions. At heart, this is an issue of equality versus equity.
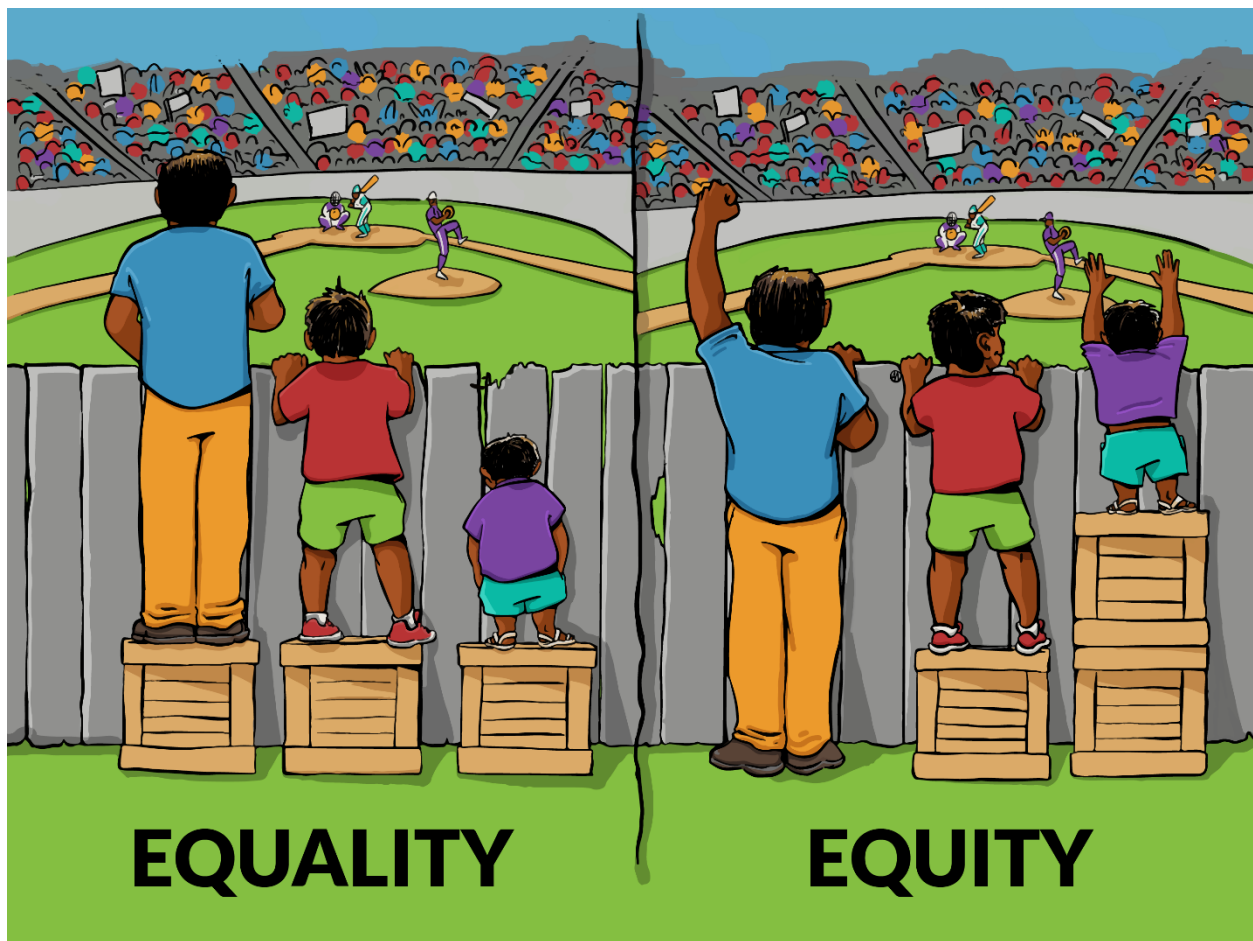
Figure 1.3. Equity vs. Equality (Interaction Institute for Social Change | Artist: Angus Maguire)

Table 1.4.

North Carolina Community College System Fall 2018 Student Counts (IPEDS, 2018)

Community College	Fall 2018 Student Information							
	Total	First-Time	Transfer	Continuing	Full-Time	Part-Time	First-Time, Full-Time	Minority Proportion
NCCCS	221,313	33838	16765	123285	81943	139373	19565	44%
Alamance	4,184	774	191	2363	1686	2498	475	22%
Asheville-Buncombe Technical	7,262	944	483	3317	2396	4866	471	39%
Beaufort County	1,500	131	41	1218	399	1101	60	55%
Bladen	1,141	161	55	633	497	644	107	24%
Blue Ridge	2,122	367	142	1005	672	1450	213	30%
Brunswick	1,425	257	73	588	575	850	176	18%
Caldwell	3,495	434	280	1496	1240	2255	276	27%
Cape Fear	8,314	1343	670	5067	3617	4700	909	19%
Carteret	1,536	239	88	1030	424	1112	91	31%

Table 1.4 (Continued.)

Community College	Fall 2018 Student Information							
	Total	First-Time	Transfer	Continuing	Full-Time	Part-Time	First-Time, Full-Time	Minority Proportion
Catawba Valley	4,827	808	230	2399	1751	3076	491	43%
Central Piedmont	5,188	751	457	2188	1878	3310	494	57%
Cleveland	19,100	2482	1347	13709	6841	12259	1327	29%
Coastal Carolina	2,700	347	144	1750	990	1710	245	38%
College of the Albemarle	4,030	775	528	2356	1964	2066	488	31%
Craven	2,507	382	387	757	875	1632	208	38%
Davidson County	3,021	277	382	1966	1126	1895	134	29%
Durham Technical	3,627	456	218	1987	1463	2164	303	66%
Edgecombe	5,415	652	720	2600	1400	4015	239	65%
Fayetteville Technical	2,198	255	175	1345	693	1505	138	63%
Forsyth Technical	11,660	2063	776	6851	4559	7101	1121	43%
Gaston College	7,756	1213	851	4538	3054	4702	770	39%
Guilford Technical	5,172	1235	714	3085	1503	3669	336	58%

Table 1.4 (Continued.)

Community College	Fall 2018 Student Information							
	Total	First-Time	Transfer	Continuing	Full-Time	Part-Time	First-Time, Full-Time	Minority Proportion
Halifax	10,072	1695	1013	7113	4361	5711	826	66%
Haywood	1,113	184	42	488	483	630	135	17%
Isothermal	1,344	437	255	511	372	972	179	25%
James Sprunt	1,929	337	55	809	769	1160	242	54%
Johnston	1,219	202	73	768	424	795	125	38%
Lenoir	4,152	589	214	1915	1546	2606	399	44%
Martin	2,664	322	182	1123	1013	1651	231	53%
Mayland	837	64	37	173	278	559	35	15%
McDowell Technical	986	87	6	628	328	658	48	16%
Mitchell	1,043	132	63	376	286	757	75	31%
Montgomery	3,204	388	134	1478	1118	2086	257	39%
Nash	925	174	70	315	314	611	121	48%
Pamlico	2,966	479	280	1374	1097	1869	330	50%

Table 1.4 (Continued.)

Community College	Fall 2018 Student Information							
	Total	First-Time	Transfer	Continuing	Full-Time	Part-Time	First-Time, Full-Time	Minority Proportion
Piedmont	462	83	27	247	161	301	42	38%
Pitt	1,311	184	33	645	403	908	105	54%
Randolph	8,256	1250	541	4737	3913	4343	923	41%
Richmond	2,747	472	59	1223	1014	1733	313	64%
Roanoke-Chowan	2,528	329	154	1165	1039	1489	220	66%
Robeson	791	87	37	322	268	523	58	80%
Rockingham	1,935	262	139	1112	803	1132	166	32%
Rowan-Cabarrus	1,931	343	90	1032	569	1362	173	38%
Sampson	5,819	1099	265	2807	3148	2671	823	53%
Sandhills	1,443	336	115	960	455	988	82	42%
South Piedmont	4,206	719	294	1720	1480	2726	485	43%
Southeastern	2,980	290	180	1075	659	2321	120	38%
Southwestern	1,450	151	54	1056	408	1042	71	21%

Table 1.4 (Continued.)

Community College	Fall 2018 Student Information							
	Total	First-Time	Transfer	Continuing	Full-Time	Part-Time	First-Time, Full-Time	Minority Proportion
Stanly	2,464	293	99	1257	844	1620	162	33%
Surry	2,540	408	129	1406	869	1671	251	24%
Tri-County	3,236	482	46	1439	1069	2167	305	8%
Vance-Granville	1,026	103	34	393	362	664	68	51%
Wake Technical	3,329	330	86	1743	1012	2317	176	50%
Wayne	22,494	3497	2494	14360	7709	14785	1843	41%
Western Piedmont	3,426	597	165	2372	1330	2096	384	23%
Wilkes	1,834	314	90	1016	775	1059	189	20%
Wilson	2,665	573	67	1226	1198	1467	407	56%

Table 1.5.

North Carolina Community College System Fall 2018 Institution Characteristics (IPEDS, 2018)

Community College	Fall 2018 Institutional Characteristics		
	Primary Award Type[a]	Primary Student Type[b]	Degree of Urbanization[c]
Alamance	Mixed	Mixed	Rural: Fringe
Asheville-Buncombe Technical	Mixed	Mixed	City: Small
Beaufort County	Mixed	Mixed	Rural: Fringe
Bladen	Mixed	High Nontraditional	Rural: Distant
Blue Ridge	Mixed	High Traditional	Suburb: Large
Brunswick	High Transfer	High Traditional	Rural: Distant
Caldwell	High Transfer	High Traditional	Suburb: Midsize
Cape Fear	Mixed	Mixed	City: Midsize
Carteret	Mixed	High Traditional	Town: Distant
Catawba Valley	High Transfer	Mixed	City: Small
Central Carolina	Mixed	Mixed	Town: Distant
Central Piedmont	High Transfer	Mixed	City: Large

Note. Primary award type, primary student type, and degree of urbanization are defined in Appendix C.

Table 1.5 (Continued.)

Community College	Fall 2018 Institutional Characteristics		
	Primary Award Type[a]	Primary Student Type[b]	Degree of Urbanization[c]
Cleveland	Mixed	Mixed	Town: Fringe
Coastal Carolina	High Career & Technical	Mixed	City: Small
College of the Albemarle	High Transfer	Mixed	Town: Distant
Craven	High Transfer	Mixed	City: Small
Davidson County	Mixed	High Traditional	Rural: Fringe
Durham Technical	High Transfer	Mixed	City: Large
Edgecombe	High Career & Technical	Mixed	Rural: Fringe
Fayetteville Technical	High Transfer	Mixed	City: Midsize
Forsyth Technical	Mixed	High Traditional	City: Midsize
Gaston College	Mixed	High Traditional	Suburb: Midsize
Guilford Technical	High Career & Technical	High Traditional	Suburb: Midsize
Halifax	High Career & Technical	Mixed	Rural: Fringe
Haywood	Mixed	High Traditional	Suburb: Large

Note. Primary award type, primary student type, and degree of urbanization are defined in Appendix C.

Table 1.5 (Continued.)

Community College	Fall 2018 Institutional Characteristics		
	Primary Award Type[a]	Primary Student Type[b]	Degree of Urbanization[c]
Isothermal	High Career & Technical	High Traditional	Town: Distant
James Sprunt	High Transfer	High Nontraditional	Rural: Distant
Johnston	High Career & Technical	High Traditional	Rural: Fringe
Lenoir	Mixed	High Nontraditional	Town: Distant
Martin	High Career & Technical	Mixed	Rural: Fringe
Mayland	Mixed	High Nontraditional	Town: Distant
McDowell Technical	Mixed	High Nontraditional	Rural: Fringe
Mitchell	High Transfer	High Traditional	Suburb: Large
Montgomery	High Career & Technical	Mixed	Rural: Fringe
Nash	Mixed	Mixed	Rural: Fringe
Pamlico	High Career & Technical	High Nontraditional	Rural: Distant
Piedmont	Mixed	Mixed	Rural: Fringe
Pitt	Mixed	Mixed	Suburb: Midsize

Note. Primary award type, primary student type, and degree of urbanization are defined in Appendix C.

Table 1.5 (Continued.)

Community College	Fall 2018 Institutional Characteristics		
	Primary Award Type[a]	Primary Student Type[b]	Degree of Urbanization[c]
Randolph	Mixed	High Traditional	Town: Fringe
Richmond	Mixed	High Traditional	Town: Distant
Roanoke-Chowan	Mixed	High Traditional	Rural: Fringe
Robeson	Mixed	Mixed	Town: Distant
Rockingham	Mixed	Mixed	Rural: Distant
Rowan-Cabarrus	High Career & Technical	Mixed	Suburb: Midsize
Sampson	Mixed	High Traditional	Town: Distant
Sandhills	Mixed	Mixed	Rural: Fringe
South Piedmont	Mixed	High Nontraditional	Rural: Distant
Southeastern	High Career & Technical	High Nontraditional	Rural: Distant
Southwestern	Mixed	High Nontraditional	Town: Distant
Stanly	Mixed	High Nontraditional	Town: Distant
Surry	Mixed	Mixed	Rural: Distant

Note. Primary award type, primary student type, and degree of urbanization are defined in Appendix C.

Table 1.5 (Continued.)

Community College	Fall 2018 Institutional Characteristics		
	Primary Award Type[a]		Primary Award Type[a]
Tri-County	High Transfer	High Nontraditional	Rural: Remote
Vance-Granville	Mixed	High Traditional	Town: Distant
Wake Technical	High Transfer	Mixed	Suburb: Large
Wayne	Mixed	Mixed	City: Small
Western Piedmont	Mixed	Mixed	City: Small
Wilkes	High Transfer	Mixed	Town: Distant
Wilson	Mixed	High Nontraditional	Town: Fringe

Note. Primary award type, primary student type, and degree of urbanization are defined in Appendix C.

While mandated by the state legislature to create an accountability system that allows colleges to be compared for a variety of purposes including additional funding, the current one-size-fits-all system that applies equally to all colleges appears to conflict with the spirit of individuality behind each community college serving local needs and constituents. Established benchmarks and approaches to defining excellence and needed improvement categories are highly problematic both mathematically and in the service of supporting students (see Appendix A).

The purpose of this study is to explore the impact of institutional characteristics on the calculation of success of NC community colleges under the current performance measures with specific consideration of persistent and systematic biases introduced through the mathematics of benchmarking using measures such as standard deviation.

Research Questions

To investigate this issue, the following research questions are addressed to identify if the construction of the NC performance measures provides equitable measures of performance and whether institutional characteristics impact a college's ability to meet performance standards.

1. Are the data used to determine baseline and excellence levels for the North Carolina community colleges performance measures normally distributed?

2. What is the relationship between institutional characteristics and the performance of community colleges as measured by the North Carolina community college performance measures?

Significance of the Study

This research is of direct significance to the 58 community colleges in NC and the communities and students they serve. By providing insight into how institutional characteristics

impact the current NC community college success measures, community colleges will have the

opportunity to make better-informed decisions when designing programs, support systems, and

partnerships to improve student success as reflected by the state measures. The research also

aims to provide insight to the State Board of Community Colleges in the development of new or

improved performance measures. While no performance measure will be perfect (Clotfelter,

Ladd, Muschkin, & Vigdor, 2013), the use of readily-available data can provide a means of

improving future iterations of the performance measures towards the end goal of equitable

comparisons. Finally, this research will provide a deeper understanding of institutional

characteristics and performance measures to the education community at large.

CHAPTER 2: REVIEW OF THE LITERATURE

Several studies have examined performance measures in higher education. The literature discussed below includes the impact of performance measures used for funding decisions, how performance measures influence changes in institutional behavior, and the impetus for the creation of performance measures that address unique institutional goals and populations. This research is grounded in principal-agent theory with assumptions for the need to develop performance measures to control the actions of the institutions they fund and provide accountability to their publics.

Theoretical Framework

The use of performance measures will be considered through the lens of principal-agent theory (Kivistö, 2008; Ross, 1973). Principal-agent theory describes the relationship between two parties: the principal and the agent. The theory maintains that when the principal chooses an agent to act on the principal's interests, the principal may then have difficulty controlling the agent, as the agent may act on dissimilar goals and information. This conflict between principal and agent may be most readily seen within an academic setting when considering the idea of academic freedom (Kivisitö, 2008) and how much academic freedom can be exercised both as the institution of higher learning as an agent of the government, and for faculty members acting as agents of the institution.

Within principal-agent theory there are two generally accepted responses from principals to exercise control of agents (Eisenhardt, 1989; Kivistö, 2008): the options are either behavior-based or outcome-based. Within the educational environment, performance measures focusing on student outcomes such as graduation are outcome-based controls. Under outcome-based controls, the agent receives a reward for achieving specific outcomes. The reward can either be

direct, such as through budget decisions, or indirect through the lack of disciplinary measures.

To exercise behavior-based controls, the principal provides incentives for specific actions, or

behaviors, on the part of the agent (Lane & Kivistö, 2008)

One of the strengths of principal-agent theory is the recognition of opportunism in the

actions of the agent (Kivistö, 2008). This aligns with other research into performance measures

which has noted specific behavior geared toward increasing performance without necessarily

serving student needs (Cullen & Reback, 2006; Figlio, 2006; Figlio & Winicki, 2005; Neal,

2013). However, critics of principal-agent theory note that it attributes all loss of control and

performance for the principal on opportunistic behavior on behalf of the agent (Donaldson, 1990;

Perrow, 1986). This can be a valid point when principal-agent theory is viewed through a narrow

lens focused entirely on how the principal can control the agent. But when viewed through a

wider lens, the theory allows for more insight into the actions of both the principal and the agent

(Kivistö).

Community College Performance Seen Through a Principal-Agent Theory Perspective

By viewing the NCCCS through the lens of principal-agent-theory, a picture begins to

emerge in which the NC State Board of Community Colleges has established performance

measures through which they exercise some level of control over the community colleges.

However, each community college acts independently based on their own unique goals, derived

to meet the needs of the community they serve. Principal-agent theory points to the differences in

goals as the cause of conflict or friction. Within the NCCCS, one principal can be defined as the

State Board of Community Colleges which has created agents in the 58 NC community colleges

(Figure 2.1).

Creates and appoints members of

North Carolina State Legislature	North Carolina State Board of Community Colleges
Goals based on representative constituency	Goals based on state-wide interpretation of law and to manage perception of legislature

Implements laws established by
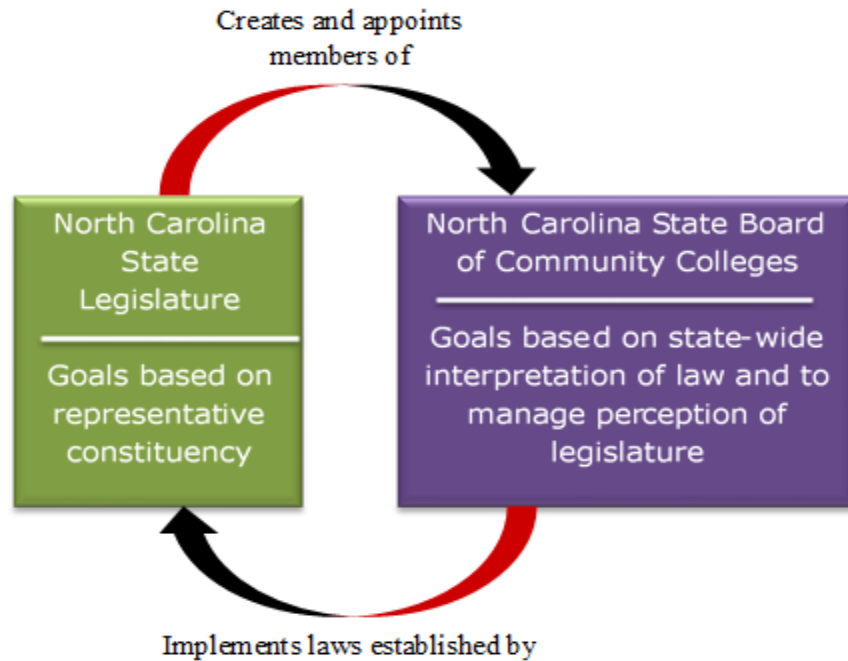
Figure 2.1. Principal-Agent Theory applied to the North Carolina State Board of Community Colleges and the NCCCS.

A second principal-agent relationship, shown in Figure 2.2, is present when viewing the relationship between the state Legislature and the NC State Board of Community Colleges. Together, these create a complex system of principals and agents like the one presented in Figure 2.3, with three primary actors within the NCCCS and each actor responding to and focused on independent goals.
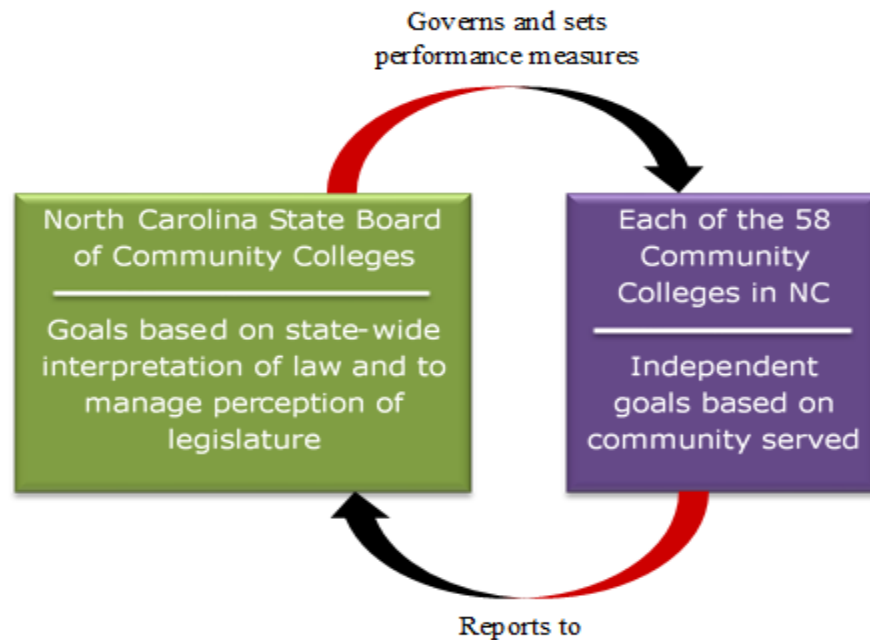
Figure 2.2 Principal Agent Theory applied to the North Carolina Legislature and the North Carolina State Board of Community Colleges
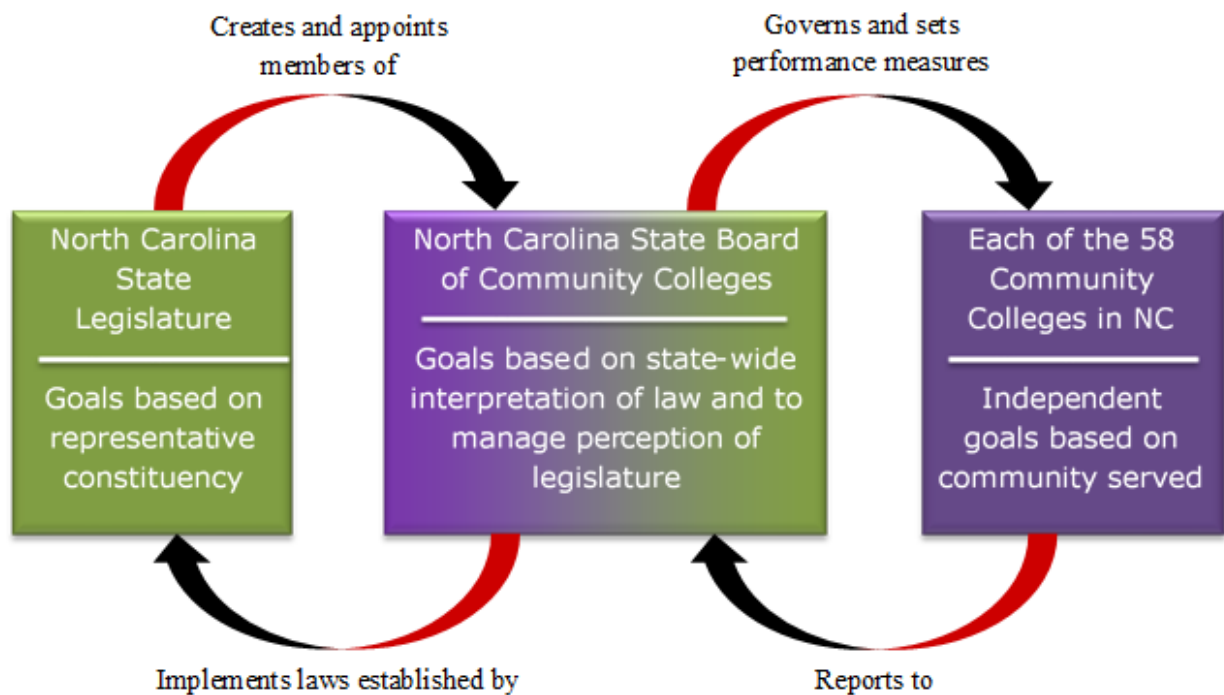
Figure 2.3 Principal-Agent theory applied to the North Carolina Community College System

In addition to understanding this key dynamic between system-level and college-level relationships, a review of the literature points to both the need for more complex institutional evaluation systems and to inequities resulting from one-size-fits-all approaches. The literature reviewed below shows that institutional characteristics influence the success of students. These characteristics are not all within the control of a community college designed to serve a specific geographic community. With the State Board of Community Colleges acting as the principal overseeing community college success and each community college acting as an agent focused on student success, principal-agent theory states that conflict between the two organizations serving different goals will arise.

The research presented in the next three chapters explores how the institutional characteristics, which serve as a proxy for the goals of the community college, impact the overall success of the institution as opposed to the individual success of the student.

A variety of current research and literature provides insight into the research problem. Research on current trends involving performance measures in higher education are discussed below. Further research from the areas of K-12, economics, and institutional characteristics are also explored. This chapter culminates in a summary how the current research presents the larger picture of performance measures in NC.

Performance Measures in Higher Education

One idea prevalent in the literature is that most performance measures do not accurately measure community college performance or that of their students (Bragg & Durham, 2012; Bragg, 2001; Burke, 1998; Burns, 2010; Clotfelter et al., 2013; Hand, 2016; Harbour & Nagy, 2005; Hill, 2004; Mullin, 2012). Bragg and Durham (2012) note that the diverse goals of community college students must be understood and taken into account to ensure that low

success rates are not blamed on students' uncertainty, ignorance, or lack of preparation in the student. The authors acknowledge the need for increased student success but also note that the very population community colleges are designed to serve with their open access admissions policies are the ones least likely to succeed. Goldrick-Rab (2010) echoes this idea by concluding that if success is based on the outcomes of all entrants, performance will be depressed unless success is very broadly defined. Goldrick-Rab also noted the need to measure success as students themselves define success. For example, a student wishing to obtain employment may take a few courses in a skilled trade and leave the college for a job, without finishing a degree. The student has achieved their goal in this situation, but the college did not create a completer. Another student may attend community college to pursue transfer; after completing a degree and successfully transferring, the student finds that fewer than half of their community college credits transferred. Should this student be considered a success?

Using performance measures based on the student definition of success can help change the conversation from simply reporting that a large number of students are not succeeding toward concrete actions to help those students succeed. The impact of narrow definitions for the student population assessed for performance measures can be seen in the low number of students represented, as shown in Table 1.2. In the Fall of 2015, there were 225,193 unduplicated curriculum students in the NCCCS (NCCCS, 2016). Of the unduplicated students, only 39,161 were represented in the student success rate in college-level English and Math measures (NCCCS, 2019a). This represents approximately 17.4% of students in the system. While some students in the Fall 2015 semester were counted in other years, based on their first term of enrollment, for these specific measures, not all enrolled students area counted.

Current research also points to concerns regarding the impact of performance measures. A study conducted by Hillman, Tandberg, and Gross (2014) shows no impact on completion rates due to financial incentives provided to community colleges and attached to performance measures. The lack of improvement in performance was echoed in NC community colleges, which did not show a steady increase in performance measures from 1998 to 2001 (Hill, 2004). In 2013, Clotfelter et al. found no correlation between student success and the NCCCS performance measures. More recently, a 2018 report showed that, on average, performance measures produce no significant changes in the number of students completing a degree (Li & Kennedy, 2018).

If performance measures are not showing a positive impact in student outcomes, what changes do state-mandated performance measures create in community colleges? Because most performance measures are characterized by a focus on outcomes (Fitzpatrick, Sanders, & Worthen, 2004), the research has identified issues with how institutions change programs to achieve better outcomes. Hillman, Tandberg, and Fryar (2015) found that colleges gradually moved toward creating more short-term certificates and fewer long-term certificates under performance measures. In 2015, Kahlenberg noted that systems of performance measurement tend to prioritize certain populations. This research corroborates literature discussed, earlier noting that the entire population of students is not considered in performance measures. Without changing their commitment to the open-access (i.e., accepting all) mission, community colleges will not be able to meet the outcomes thrust upon them when these outcomes evaluate a small percentage of the entire student population served by community colleges (Bragg, 2001).

The literature does not present a favorable picture for current performance measures in higher education. However, the research still supports the need for assessing higher education's

performance. As higher education provides nonpecuniary benefits to students (Oreopoulos & Salvanes, 2011), ensuring the quality of their education has been a focus of researchers and practitioners. But to equitably assess the success of higher education, the structure of performance measures must provide information that leads to improvement. This begins by ensuring adequate data resources are available (Bragg & Durham, 2012; Melguizo, Zamarro, Velasco, & Sanchez, 2017). Further, for measures to promote student success, colleges must have a clear definition of student success. This definition can vary from student to student even within the same institution (Bragg & Durham 2012; Goldrick-Rab, 2010; Matsudaira, 2016).

One conclusion discussed in the literature is that further research on the use of performance measures in higher education is necessary. While Tandberg and Hillman (2014) noted no significant increase in baccalaureate degree completion with performance measures, the authors did see limited positive gains after seven years. The idea of long-term impact to the student is also one that should be considered in future research. Horn, Nevill, and Griffith (2006) noted that 42% of community college students seek job skills and that 80% of community colleges students expect to earn some kind of credential. Without assessing the long-term benefits to students for the skills and credentials earned, performance measures are effectively taking for granted the benefits associated with attending (Matsudaira, 2016).

The assessment of institutional assessment is not restricted to higher education and is used in many K-12 education environments. Performance measures have been used in the K-12 education context for decades (Deming & Figlio, 2016) and can be useful in this research by providing further insight into additional uses of performance measures. A broader understanding of how institutional characteristics impact individual student learning can identify institutional characteristics of interest in understanding community college performance.

Gainful employment. The recently-revoked ("Program integrity: Gainful employment," 2019) gainful employment regulations proposed by the federal government in 2014 are one method used to assess the performance of United States colleges and universities. Originally developed to monitor college performance and provide a measure of consumer protection (Heller, 2011; "Program integrity: Gainful Employment," 2019), the regulation-imposed sanctions on institutions that failed to meet specific performance benchmarks. This regulation became a de-facto outcomes-based control mechanism under principal-agent theory. Institutions that failed to meet required benchmarks were to be denied access to federal funds in the form of student aid, which in turn would limit the number of students attending the institution.

The measures used as part of the gainful employment metric were debt-to-earning ratios. This metric aimed to identify institutions that graduated students with exceptionally high debt compared to graduates from similar programs, and those institutions whose graduates had exceptionally lower income than other comparable graduates. This metric is notable as it aims to tackle issues related to the labor market. However, these measures were ultimately rescinded for a number of reasons.

One particular reason for rescinding the gainful employment measures was a lack of accurate income data for graduates ("Program integrity: Gainful employment," 2019). This is interesting as community colleges cited a lack of income data as a reason for not using labor market outcomes in the evaluation (Stevens, Kurlaender, & Grosz, 2019). Another reason noted for rescinding the gainful employment measures is that research indicates that student loan default rates are largely influenced by demographics (Lochner & Monge-Narango, 2014). This suggests that gainful employment outcomes are a poor measure of institutional quality. Similar research by Baum and Johnson (2015) shows borrowing levels are attributable to student

characteristics and do not measure institutional quality. These findings are similar to the research questions being explored in this research; namely, there are problems with a one-size-fits-all approach to assessing college performance. In the case of the gainful employment measures, an attempt was made to assess all 2-year, 4-year, non-profit, and for-profit institutions of higher learning using the same metric, which obviously serve different communities and have different goals and drivers.

It is interesting to note that the American Council on Education did not support the rescission of the gainful employment measures, instead pushing for reform of the measures. ("Department of Education Repeals Gainful Employment Regulations," 2019). Their support of revisions, along with that of 21 other organizations related to higher education, indicates changes are needed to provide robust measures of college performance that accurately reflect the needs and characteristics of the students, and by extension the institutions.

Labor market outcomes. Community colleges are widely viewed as an economic alternative to university that results in economic mobility for students without a bachelor's degree (Bahr, 2016; Bol, Eller, van de Werfhorst, & DiPrete, 2019; Bosworth, 2010; Harmon & MacAllum, 2003). While research regarding the true economic impact of community college programs has not been fully developed (Stevens et al., 2019), early research is showing promising results (Dadgar & Trimble, 2015; Stevens et al., 2019). This becomes relevant as the NCCCS includes workforce development in the system mission statement and in the curriculum for the 58 community colleges. Labor market outcomes are not included in any of the NC community college performance measures, but should be considered in the future, or the benefit of the NC community college measures comes into question.

Current research, while not exhaustive, shows a positive economic impact from associate degrees focused on career and technical education (Dadgar & Trimble, 2015; Stevens et al., 2019). However, the research also indicates that the scope of impact is varied. Programs of the same length (requiring the same number of credit hours) have different returns to the students (Dadgar & Trimble; Grubb, 2002). However, even within the same program, students have differing economic returns. Current research also notes the lack of diversity with the student population of many such programs (Stevens et al., 2019), calling into question how student demographics impact labor market outcomes. What does become clear is that, even with the difficulties and emerging research surrounding labor market outcomes, students need additional information on the expected outcomes of their program so they make informed decisions about their education (Grubb, 2002; Klor de Alva & Schneider, 2013). Community colleges also need this information to help improve and develop programs.

The predominant method for establishing labor market outcomes is longitudinal data tracking (Dadgar & Trimble, 2019; Stevens et al., 2019). Unfortunately, obtaining accurate and actionable labor market information difficult (Stevens, Kurlaender, & Grosz, 2019).

Complete College Tennessee Act. The Complete College Tennessee Act (CCTA) was passed in January of 2010 (Nwosu & Koller, 2014). The CCTA was an attempt to raise the postsecondary degree production in the state of Tennessee. The metrics used for this act also served as a one-size-fits-all measure of college performance. CCTA measured the number of students meeting credit hours thresholds (24, 48, and 72); the number of degrees produced; research expenditures; transfer performance; and the six-year graduation rate. Notable within this performance measure, the state provides for additional weight to students from specific demographics. Namely, adult students (over the age of 25) and low-income undergraduates

(Complete College Tennessee Act of 2010, 2010) that fall into any metric are worth 20% more

toward the overall college performance. Additionally, the CCTA allows for each of the metrics

used to be weighted based on institutional characteristics. While not an appropriate choice for all

performance measures across the nation, Nwosu and Koller (2014) note that this model has the

key components of efficiency, quality, and accountability necessary in a performance assessment

model.

Insights from performance measures in K-12

While performance measures are beginning to flourish in the post-secondary education

setting, their use in K-12 education has a much longer history. Public primary and secondary

education have been subjected to performance measures for decades (Deming & Figlio, 2016).

With a longer timeframe of structured accountability comes a larger breadth of research into

performance measures. Deming and Figlio (2016) noted that performance measures in primary

and secondary education are here to stay, in some shape or another. And while these measures do

work, they rarely work in the way intended by those requiring the measures.

Sanctions for failing to meet performance standards were used heavily after adoption of

the No Child Left Behind Act of 2001 (Deming & Figlio, 2016). This represents another

outcome-based control under principal-agent theory, as schools that met the required levels were

rewarded with the absence of a penalty (Kivistö, 2008). However, research into this high-stakes

accountability has shown that such methods result in institutions, or people within the institution,

making strategic behavior decisions to improve accountability without necessarily improving

student performance (Figlio & Kenny, 2009; Figlio & Lucas, 2004). Further research (Neal,

2013) points to the effect identified by Campbell (1976) who stated, "The more any quantitative

social indicator is used for social decision-making, the more subject it will be to corruption

pressures and the more apt it will be to distort and corrupt the social processes it is intended to monitor." Systems of measurement created and used within K-12 settings serve two purposes, both to measure quality/success and to provide information for improvement. However, the systems became corrupted and could no longer faithfully serve either purpose. This has been documented in multiple studies showing that school officials manipulated students, reclassified them as disabled, or suspended them in order to achieve better results on No Child Left Behind performance measures (Cullen & Reback, 2006; Figlio, 2006; Figlio & Winicki, 2005).

The research on performance measures in the K-12 environment is not entirely negative. There is strong positive research indicating that accountability measures have the largest impact on the lowest-achieving students (Carnoy & Loeb, 2002; Dee & Jacob, 2011), which highlights the need to ensure that accountability measures are in place to support public education and institution improvement. At the same time, oversight agencies must create measures in such a way that the measures cannot be manipulated to make schools appear better than they are. The measures must be used to improve student outcomes as opposed to school outcomes.

Research shows that assessment is needed as a tool to improve student success. Assessment alone is not enough, there is a need to identify student characteristics which impact student success. What characteristics of the student body as a collective impact student success? In other words, it is important to consider institutional characteristics that impact student success and. therefore, institutional performance.

Value added models. Discussion of whether to assess status or growth is central to assessment in primary education. A status model focuses on whether students achieve preset benchmarks at specific times. The student and school are being measured against known benchmarks to determine their achievement status. A growth model, found in value added

models, focuses on how student performance has changed over a specific time period. The achievement of specific benchmarks at given times becomes irrelevant (Ladd & Lauen, 2010). Both growth and status models for assessing student achievement have been noted to have an impact on student achievement in NC (Ladd & Lauen, 2010).

Value added models are one framework for assessment found in public elementary and secondary education that represent a growth model (Ladd & Walsh, 2002). Ladd and Walsh note the benefit of value added models due to their reliance on relative change of student performance over a specific time period. This allows for an underperforming student to show progress without necessarily meeting grade-level standards. This benefit is important because more traditional models of assessment (e.g. status models) rely on standardized benchmarks which are largely impacted by student socioeconomic status (Clotfelter & Ladd, 1996). However, a value added model also has drawbacks that may limit the ability of such performance measures to provide information that improves student success.

One such drawback is that value added models rely on testing of students at the beginning and end of each study period (Ladd, 2001). This method is criticized for the impact it can have on teachers, such as teaching to the test (Kohn, 2001). With the heavy reliance on student performance improvement, value added models have also been criticized for focusing accountability on the teacher and not the student (Ladd, 2001). This, in turn, can lead to higher turnover in low performing schools and difficulty in recruiting quality teachers (Clotfelter, Ladd, Vigdor, & Diaz, 2004).

The Impact of Institutional Characteristics on Student Success

There is significant research that argues individual student characteristics impact student performance (Bers & Schuetz, 2014; Borman & Dowling, 2010; Kurlaender, Carrell, & Jackson,

2016; Zimmerman, 2014). By extension, do institutional characteristics, such as primary demographic, size, and location also impact college performance? Research shows that institutional characteristics impact the success of students upon transfer, which is a performance measure in NC. For community colleges that have a higher focus on transfer programs, students were more likely to be successful upon transfer (Hill, 2004; Mast, 2017). Because community colleges develop programs to meet the needs of their community, the focus for each college may not always be on transfer programs. In NC, 11 community colleges are classified as having a high number of career and technical programs (IPEDS, 2018), meaning that over 50% of the credentials awarded are from career and technical programs (The Carnegie Classification of Institutions [Carnegie], n.d.). The NC community college performance measures compares the performance of these 11 community colleges to the performance of other institutions in the state, institutions that research has shown will have a higher successful transfer performance.

Research has identified that the percentage of females enrolled also has a positive correlation with transfer success (Bailey et al., 2005; Hill, 2004). In 2018, all community colleges in NC had a higher proportion of females than males enrolled (IPEDS, 2018). While the research does not specifically correlate higher female enrollment to lower career and technical performance, this does present an avenue of research worth exploring.

Transfer success is not the only performance measure influenced by institutional characteristics. Graduation rates have are influenced by the proportion of students that receive Pell funding, the proportion of minority students, and the size of the institution (Bailey et al., 2005, 2008). Minority enrollment in community colleges in NC ranges from 8% to 80%, with 16 institutions having over 50% enrollment from minority populations (IPEDS, 2018). The same data also show that the proportion of students receiving Pell grants ranges from 15% to 69%,

with 11 institutions awarding Pell grants to the majority of their students. The size of the college is depends on the community served by the college. Each college serves a defined geographic area (Quinterno, 2008). The population within the service area impacts the number of students enrolling at a community college. The 2018 IPEDS data show that Fall 2017 enrollment varied from 462 students to 22,494 students. Knowing that enrollment impacts completion rates, what kind of impact is there when there is a 4,768% difference in college size between the smallest (Pamlico Community College) and the largest (Wake Technical Community College) institutions in the state?

Graduation rates are also higher at institutions with an emphasis on certificate programs as opposed to associate degree programs (Alfonso, Bailey, & Scott, 2005; Bailey, Calcagno, Jenkins, Leinbach, & Kienzl, 2006; Bailey & Xu, 2012; Scott-Clayton & Weiss, 2011). Without any assumptions of community colleges engaging in opportunistic behavior geared toward gaming the system of performance measures, community colleges in NC may have differing foci based on their community's industry needs (i.e., certificates values). This in turn can impact the graduation rates used to measure performance.

The population of the service area also influences the level of urbanization in the surrounding area. Mast (2017) shows that transfer students are more likely to complete at an urban institution and career and technical students are more likely to complete at non-urban institutions. There are 22 community colleges classified as serving a rural area in NC (IPEDS, 2018). Of the 22 community colleges serving rural areas, three are classified as high transfer (IPEDS, 2018), indicating that at least 70% of awards are not for career and technical programs (Carnegie, n.d.). Another 12 community colleges are classified as mixed, indicating 51% to 70% of credentials are transfer oriented. This indicates there are 15 community colleges serving rural

areas with over half of students working toward a transfer credential. While the research does not indicate a negative correlation between community colleges serving rural areas and transfer success, the question remains whether these students are likely to complete in a workforce focused program. Even if they are more likely to complete, would this represent success for the student?

Research indicates that schools with the highest percentage of part-time instructional staff are more likely to have a lower graduation rate (Bailey et al., 2005; Jacoby, 2006). In NC, the proportion of full-time faculty at a community college varies across the state. In some areas, colleges having lower enrollments may not need full-time faculty for specific subject areas. The local job market also impacts the availability of full-time faculty in each region. The percentage of part-time instructional staff employed by each NC community college varies from 39% to 85%. This reveals another area where institutional characteristics may have an impact on student success and potentially overall college performance.

The research reviewed indicates a strong need for performance measures that accurately reflect the population of students attending community colleges. The research also points to multiple student characteristics that impact student success. The student characteristics identified in existing literature have allowed for the identification of institutional characteristics that may impact the success of higher education institutions. Focusing on those institutional characteristics for which data is readily available will allow for research to be conducted that has the potential to inform the construction of future performance measures that are more equitable to institutions across North Carolina.

CHAPTER 3: METHODOLOGY

The NC community college performance measures have an impact across all 58 community colleges in the state. While the $21 million appropriated through the performance measures in the 2018 fiscal year (State Board of Community Colleges Finance and Operations Division, 2018) only represents approximately 1.5% of the allocated budget, the potential for higher performance budget allocations does remain. Additionally, the perception of college performance given the methodology used to construct the performance measures should be considered. The purpose of this study is to examine the relationships between institutional characteristics and the NC community college performance measures.

Theoretical Framework

Principal-agent theory applied to the NCCCS identifies community colleges as agents of the State Board and by extension the NC Legislature. From this perspective, the performance measures are a means of controlling the community colleges. Principal-agent theory assumes the performance measures are a mechanism by which the State Board controls community colleges. Specifically, the performance measures are outcome-based controls as the performance measures do not require a specific behavior of the community college and look for specific outcomes. However, the State Board chooses the goals of the state performance measures, whereas the community colleges take actions designed to support the needs of the community served.

Through this framework, institutional characteristics serve as a proxy for community need. A college that awards a higher number of career and technical credentials does so because the community requires career and technical programs. A community college whose student population is primarily minority students is likewise serving the surrounding community. The purpose of this research is to identify if the actions of the principal to control the agent are

impacted by the agent's choices to serve their community. More clearly stated, this study explores whether the construction of the NC Performance Measures provides an equitable measure of performance and whether institutional characteristics impact a college's ability to meet performance standards.

Research Questions

The following research questions are addressed:

1. Are the data used to determine baseline and excellence levels for the North Carolina community colleges performance measures normally distributed?

2. What is the relationship between institutional characteristics and the performance of community colleges as measured by the North Carolina community college performance measures?

Research Approach

Quantitative analyses were performed using key metrics of success as defined by the NC community college performance measures as dependent variables. Independent variables included institutional characteristics as shown in Table 3.1. Data used for this research are all publicly available and comes from two primary sources: the NCCCS and the Integrated Postsecondary Education Data System.

Table 3.1.

Dependent and Independent Research Variables

Dependent Variables – Success Measures	Independent Variables – Institutional Characteristic
Success level on basic skills measure	Carnegie classification award type
	Carnegie classification student type
Success level on college-level English measure	Degree of urbanization
	Majority minority status
Success level on college-level Math measure	College Size
	Proportion of students receiving Pell
Success level on first year progression measure	Proportion of students classified as first-time
	Proportion of students classified as full-time
Success level on curriculum student completion measure	Proportion of students classified as full-time, first-time
	Proportion of students classified as transfer
Success level on college transfer performance measure	Proportion of students classified as continuing
	Proportion of students classified as non-degree/certificate seeking
Success level on licensure and certification performance measure	Proportion of instructional staff classified as part-time
	County economic tier

Data Collection

Data were collected from three different publicly available sources.

North Carolina community college performance measure data. Success data for each

institution were obtained from the NCCCS. Data are publicly available at

https://www.nccommunitycolleges.edu/analytics/dashboards. However, to aid in computation, an Excel version of the data was obtained. The NCCCS routinely shares data in this format with community college planners and data analysts. Bill Schneider, Associate Vice President of Research and Performance Management, provided permission to use the data file (Schneider, B., personal communication, October 14, 2019). From this data set, the variables defined in Table 3.2 were recorded for each of the 58 community colleges in NC. Variable values for each of the community colleges in NC is available in Appendix B.

Table 3.2.

Dependent Variable Definitions (NCCCS, 2019a).

Dependent Variables	Variable Definition
Basic skills success	The percentage of adult education students demonstrating a measurable skills gain in the program year July 1, 2017 through June 30, 2018.
College-Level English Success	The percentage of first-time associate degree seeking and transfer pathway students from the Fall 2015 semester which passed a credit-bearing English course within three years.
College-Level Math Success	The percentage of first-time associate degree seeking and transfer pathway students from the Fall 2015 semester which passed a credit-bearing Math course within three years.
First-Year progression	The percentage of first-time credential seeking curriculum students which graduated prior to or enrolled in postsecondary education the subsequent fall semester.
Curriculum Completion	The percentage of first-time credential seeking curriculum students which graduate or transfer to a four-year institution within four-years or are enrolled in the fourth academic year and has completed at least 42 non-developmental hours.
Transfer Performance	Of the community college students who completed an associate degree in the 2016 – 2017 academic year or completed 30 articulated transfer credits at a community college in the same academic year and then enrolled at a four-year institution in the Fall 2017 semester, the percentage that were enrolled in a four-year institution for the Fall 2018 semester or graduated with a bachelor's degree or higher prior to the Fall 2018 semester.
Licensure pass rate	A weighted index score of first-time test-takers on state mandated licensure and certification exams for the 2017 -2018 academic year.

Institutional characteristics. Institutional characteristics are collected for the Integrated Postsecondary Education Data System. All data come from the final release information made publicly available. Institutional characteristics data are defined in Table 3.3.

Table 3.3.

Independent Variable Definitions

Independent Variables	Variable Definition
Carnegie award type	Colleges are categorized as either high transfer, high career and technical, or mixed transfer/career and technical (IPEDS, 2018). [a]
Carnegie student type	Colleges are categorized as having a student type that is either high traditional, high nontraditional, or mixed traditional/non-traditional (IPEDS, 2018). [a]
Degree of urbanization	A classification representing the urbanicity by population size. The code for each institution was assigned using a methodology developed by the U.S. Census Bureau's Population division (IPEDS, 2019). [a]
Modified degree of urbanization	Degree of urbanization variables recoded into four categories, ignoring the distance/size portion of the degree of urbanization classification. Each community college noted as either rural, town, suburb, or city.
Majority minority	A binary variable calculated based on the race and ethnicity demographics of an institution. Any institution whose fall 2017 enrollment was composed of less than 50% white was categorized as having a majority minority.
Proportion of student reported as female	The proportion of students reported to IPEDS for the Fall 2017 semester that were reported as female (IPEDS, 2017).
Number of students	The total number of students Based on the number of students from the Fall 2017 semester, both credential and non-credential seeking (IPEDS, 2017).
College size	Total students variable reclassified as either small (less than 1,000 students), medium (between 1,000 and 4,999 students), large (between 5,000 and 9,999 students), or extra-large (10,000 or more students).

Table 3.3 (Continued.)

Independent Variables	Variable Definition
Pell category	The proportion of students receiving Pell grants variable recoded into three categories. Low Pell colleges are those with one-third (33%) or fewer students receiving Pell. High Pell colleges are those with over 50% of students receiving Pell. Colleges with between 34% and 50% of students receiving Pell are classified as medium Pell colleges.
Proportion of students classified as first-time	The proportion of students attending the institution which were classified as first-time in the Fall 2017 semester. [a]
Proportion of students classified as full-time	The proportion of students attending the institution which were classified as full-time in the Fall 2017 semester. [a]
Proportion of students classified as full-time, first time	The proportion of students attending the institution which were classified as both first-time and full-time in the Fall 2017 semester.
Proportion of students classified as transfer	The proportion of students attending the institution which were classified as a transfer student in the Fall 2017 semester. [a]
Proportion of students classified as continuing	The proportion of students attending the institution which were classified as a continuing student in the Fall 2017 semester.
Proportion of students classified as non-degree/certificate seeking	The proportion of students attending the institution which were classified as a non-degree/certificate seeking student in the Fall 2017 semester. [a]
Proportion of instructional staff that are part-time	A calculated variable that shows the percentage of instructional staff at the institution that are classified as part-time by the institution. (IPEDS, n.d.c).

[a]: Additional information regarding this variable is available in Appendix C

County economic tier. One final variable not found with institutional IPEDS data was used. County economic tier is a calculated variable indicating the average county distress rating, as determined by the NC Department of Commerce, of the counties served by each community college. Data is based on the service area assignments found in the NCCCS Curriculum

Procedures Reference Manual Section 18 (NCCCS, 2019c) and the 2019 NC Development Tier

Designations (NC Department of Commerce, 2019).

   Excluded variables. A number of potential institutional characteristic variables, such as

proportion of first generation, student income, and average number of hours worked by students.

are excluded from this study. In an effort to make the research useful in the construction of future

performance measures, the decision was made to focus on institutional characteristics that could

be identified with currently existing data.

Data Analysis

   Initial analysis focused on testing the normality of the state performance measures. This

was done through the calculation of kurtosis and skewness values and an examination of Q-Q

plots. Normality was also tested using the Shaprio-Wilk test. These results were summarized and

used as the basis for the answer to research question 1.

   To determine if there is a correlation between the independent variables represented in

institutional characteristics and the dependent variables of success on a given performance

measure, multiple tests were used. For categorical dependent variables, a Kruskal-Wallis test was

performed. Follow-up Mann-Whitney U tests were used to investigate the pairwise correlation

for any significant correlation found through the Kruskal-Wallis test. For non-categorical

dependent variables, Kendall's τ_b was calculated and analyzed. These results were summarized

to determine whether systemic inequities are introduced by the way state-wide performance

measures that are constructed to assess community college effectiveness, provide funding, and

meet the needs of students and are the basis for the answer to research question 2.

Potential Implications

This study has potential implications on how future performance measures for NC community colleges are constructed. Recommendations to address systemic inequities in the performance measures are provided in Chapter 5. These recommendations are guided by the need to allow each NC community college to serve their unique population while also allowing the State Board of Community Colleges to track community college performance and provide funding to institutions based on performance.

Subjectivity

I am an administrator at a large community college in NC. In my role, I oversee assessment for all curriculum programs and courses and advocate for the use of assessment as a tool to promote improvement and not as a mandated requirement. To facilitate assessment at all levels of the college, I have expanded on my mathematics background to include strong skills in the analysis of data. This role has resulted in contributions as the data analyst for large scale projects in areas of curriculum, human resources, and finance. My mathematics background has motivated me to question the current NC community college performance measures and, in turn, to pursue research into methods that would better allow colleges to monitor performance in a productive manner.

Limitations

Because the data came from multiple years ranging from 2014 to 2018, there are limitations inherent in comparing data from different years. While not ideal, the data used are the most recent data available for any given measure. This is the same practice used for the NC community college performance measures which also use data from different years for each measure.

The study is further limited by the choice of institutional characteristic variables. Variables not presented in this paper may also have a correlation with college performance on the NC measures. It is not possible to choose all possible variables; therefore, this research focuses on the variables available and discussed in the literature.

Ethics and IRB

Institutional Review Board approval for this research is not required as all data are publicly available. At the request of the NCCCS, data representing five or fewer students are not presented in this research (Schneider, B., personal communication, October 14, 2019). Variables identified in this research do not represent an inherent value of the college based on the variable. The variables represent the institutional characteristics of the institution that serves a specific community.

Chapter Summary

This chapter described the steps that will be taken to analyze the normality of NC Community College Performance Measure data and examine the data for correlations with identified institutional characteristics. The next chapter will present the findings from the statistical tests performed (Kruskal-Wallis, Mann-Whitney U, Kendall's τ_b, Kurtosis, Skewness, and Shapiro-Wilk). Chapter 4 will also discuss the interpretation of the findings, in the context of North Carolina Community Colleges.

CHAPTER 4: RESEARCH FINDINGS

This study explores whether the construction of the North Carolina Community College System Performance Measures provides an equitable measure of performance and whether institutional characteristics impact a college's ability to meet performance standards. Statistical analyses were completed on institutional characteristic variables and NC community college performance measures to address the following questions:

1. Are the data used to determine baseline and excellence levels for the North Carolina community colleges performance measures normally distributed?

2. What is the relationship between institutional characteristics and the performance of community colleges as measured by the North Carolina community college performance measures?

This chapter presents the findings of the statistical analyses and explores what these results indicate pertaining to these specific research questions. Chapter Five considers the implications of these findings and makes recommendations for changes to the process used in North Carolina to assess community colleges in the state-wide system.

Tests for Normality

To address the first research question, the kurtosis and skewness values for each of the dependent variables associated with a NC community college performance measure was determined and is displayed in table 4.1. Skewness and kurtosis values closer to zero generally indicate a distribution that is more normally distributed (Mertler & Reinhart, 2017).

Table 4.1.

North Carolina Community College Performance Measures Test for Normality

	M	SD	Skewness	Kurtosis
Basic Skills Progress	41.82%	8.83%	-.346	.856
Credit English Success	60.99%	7.71%	-.322	-.448
Credit Math Success	41.49%	8.13%	.159	-.833
First Year Progression	68.25%	4.89%	-.438	1.78
Curriculum Completion	49.29%	4.90%	-.033	.158
Transfer Performance	85.17%	4.13%	-1.097	3.293
Licensure Pass Rate	.9778	.09540	-1.196	4.105

Note. N = 58 for all performance measures.

Skewness represents how much departure there is from horizontal symmetry. This is important when evaluating data for normality as the normal distribution has perfect horizontal symmetry, represented with a skewness of 0. A positive skewness value indicates that that the data is skewed to the right or positively skewed. This means that the mean of the data is to the right of, or larger than, the median. Likewise, a negative skewness value indicates that the data is skewed to the left or negatively skewed. This means that the mean of the data is to the left of, or smaller than, the median. Skewness values between -0.5 and 0.5 are considered approximately symmetric. Skewness values less than -1 or greater than 1 indicate a distribution that is highly skewed. In the NC community college performance data, both the transfer performance and licensure pass rate distributions are shown as highly negatively skewed. This means that for these two measures, there are more low-performing colleges than high-performing community colleges.

Kurtosis examines the source of the variance in a distribution. For a normal distribution, the Kurtosis value is 0. Kurtosis values larger than 0 indicate a leptokurtic distribution of data in which the variance is attributed to a few data with a large deviation from the mean. Kurtosis values less than 0 indicate a platykurtic distribution of data in which the variance is attributed to a high frequency of data with moderate deviation from the mean. In the NC community college performance data, the first year progression, transfer performance, and licensure pass rate measures all have a positive kurtosis value. This indicates that each measure does not follow a symmetric normal distribution and has a few values far from the average score. This means that for these three measures, there some colleges performing either extremely well or extremely poorly, something that would not be evident in a normal distribution.

As the kurtosis and skewness values are subject to interpretation, further investigation into normality was performed using the Shapiro-Wilk test.

Under the Shapiro-Wilk test, the following hypotheses are used:

H_o: The performance measure variable is normally distributed

H_a: The performance measure variable is not normally distributed

The results of the Shapiro-Wilk test are summarized in Table 4.2.

Table 4.2.

North Carolina community college performance measures Shapiro-Wilk test

	Statistics	df	Sig
Basic Skills Progress	.981	58	.478
Credit English Success	.979	58	.392
Credit Math Success	.975	58	.282

Table 4.2 (Continued.)

	Statistics	df	Sig
First Year Progression	.949	58	.017*
Curriculum Completion	.994	58	.996
Transfer Performance	.939	58	.006**
Licensure Pass Rate	.921	58	.001**

Note. N = 58 for all performance measures.
* significant at the *p* < 0.05 level
** significant at the p < 0.001 level

For the first year progression performance measure, a Shapiro-Wilk test showed a significant departure from normality (W(58) = 0.949, p = 0.017). This value indicates that the null hypothesis should be rejected, and that the data is not from a normal distribution. Similar results are even stronger for the transfer performance (W(58) = 0.939, p = 0.006) and licensure pass rate (W(58) = 0.921, p = 0.001) measures, also indicating the data is not from a normal distribution. . This means that for these measures, community college performance tends to be focused around the system average with a few colleges have extremely high or low success rates. This type of distribution indicates that the current practice of using standard deviation to determine baseline and excellence levels is not appropriate.

Skewness, Kurtosis, and the Shapiro-Wilk test indicate that the transfer performance and licensure pass rate data is not normally distributed. The first year performance measure had an approximately normal skewness value. However, the kurtosis value and the Shapiro-Wilk test indicates the first year progression data is not normally distributed. This indicates a distribution that, while symmetric, is heavily influenced by a few extreme values, such as Pamlico Community College's 68.8% success on transfer performance, a value much lower than the next

highest value of 76.3% (James Sprunt Community College). The difference between Pamlico and James Sprunt Community College also represents the largest difference between any two successive colleges.

The above results have added significance in relation to the transfer performance measure. Under the normal distribution, the 2018 transfer performance measure had a system average of 85.17% (NCCCS, 2019). Using a binomial distribution would result in a system average of 85.9%. This change in the system average would result in a change in performance levels for the four NC community colleges shown in Table 4.3.

Table 4.3.

Transfer performance measures for select North Carolina community colleges

Community College	Transfer Performance
Davidson County	85.80%
Randolph	85.40%
Sampson	85.20%
Western Piedmont	85.40%

These four community colleges do not share institutional characteristics that would indicate a specific type of community college is impacted by the use of normal distributions. Instead, this study indicates that there is a difference based on how the system average is calculated that can impact community college success levels in NC.

Variable Correlation

Carnegie Classification award type. A Kruskal-Wallis test was conducted to evaluate differences among the three Carnegie classification award types (high career & technical, mixed, and high transfer) on median performance in each of the NC community college performance

measures. The test, which was corrected for tied ranks, was not significant (see Table 4.4) for

any of the NC community college performance measures. These results indicate that there are no

identifiable differences in the performance of NC community colleges based on the college

having a classification of high-transfer, high career/technical, or mixed primary award type.

Table 4.4.

North Carolina Community College Performance Measures Kruskal-Wallis test with Carnegie classification award type as grouping variable

Performance Measure	Kruskal-Wallis H	df	sig.
Basic Skills Progress	2.664	2	0.264
Credit English Success	2.428	2	0.297
Credit Math Success	3.719	2	0.156
First Year Progression	0.739	2	0.691
Curriculum Completion	1.466	2	0.480
Transfer Performance	0.326	2	0.850
Licensure Pass Rate	2.464	2	0.292

With no significant differences between Carnegie classification award types on any of the NC

community college performance measures, follow-up pairwise tests were not conducted.

Carnegie classification student type. In addition to looking at Carnegie classification

from the perspective of output success measures, a Kruskal-Wallis test was conducted to

evaluate differences among the three Carnegie classification award types (high nontraditional,

mixed, and high traditional) on median performance in each of the NC community college

performance measures. The test, which was corrected for tied ranks, was not significant (see

table 4.5) for any of the NC community college performance measures. These results indicate

that there are no identifiable differences in the performance of NC community colleges based on

the college having a classification of high-traditional, high non-traditional, or mixed student

type.

Table 4.5.

North Carolina Community College Performance Measures Kruskal-Wallis test with Carnegie classification student type as grouping variable

Performance Measure	Kruskal-Wallis H	df	sig.
Basic Skills Progress	1.483	2	0.476
Credit English Success	0.047	2	0.977
Credit Math Success	1.497	2	0.473
First Year Progression	3.091	2	0.213
Curriculum Completion	3.059	2	0.217
Transfer Performance	4.136	2	0.126
Licensure Pass Rate	3.391	2	0.184

With no significant differences between Carnegie classification student types on any of the NC

community college performance measures, follow-up pairwise tests were not conducted.

Degree of urbanization. A Kruskal-Wallis test was conducted to evaluate differences

among the ten degrees of urbanization levels (rural: remote, rural: fringe, rural: distant, town:

fringe, town: distant, suburb: midsize, suburb: large, city: small, city: midsize, and city: large) on

median performance in each of the NC community college performance measures. The test,

which was corrected for tied ranks, was not significant (see Table 4.6) for any of the NC

community college performance measures. These results indicate that there are no identifiable

differences in the performance of NC community colleges based on their degree of urbanization.

Table 4.6.

North Carolina Community College Performance Measures Kruskal-Wallis test with degree of urbanization as grouping variable

Performance Measure	Kruskal-Wallis H	df	sig.
Basic Skills Progress	9.657	9	0.379
Credit English Success	12.160	9	0.204
Credit Math Success	8.788	9	0.457
First Year Progression	13.854	9	0.136
Curriculum Completion	13.634	9	0.136
Transfer Performance	14.016	9	0.122
Licensure Pass Rate	12.731	9	0.175

With no significant differences between Carnegie classification student types on any of the NC

community college performance measures, follow-up pairwise tests were not conducted.

Considering the large number of variables under degree of urbanization, with both

distance to and type of population center, further exploration into this variable is warranted.

Degree of urbanization variables were then recoded into four categories, ignoring the

distance/size portion of the degree of urbanization classification. Each community college was

noted as either rural, town, suburb, or city. An additional Kruskal-Wallis test was conducted to

evaluate differences among the four modified degree of urbanization levels (rural, town, suburb,

or city) on median performance in each of the NC community college performance measures.

The test, which was corrected for tied ranks, was significant for the first year progression (χ^2(2,

58) = 9.615, p = 0.022) and licensure pass rate measures (χ^2(2, 58) = 8.462, p = 0.037). The test

was not significant for any other performance measure (see Table 4.7). These results indicate that

the type nearby urbanization (rural, town, suburb, or city) has an impact on first year progression

and licensure pass rates, but not on the other performance measures.

Table 4.7.

North Carolina Community College Performance Measures Kruskal-Wallis test with modified degree of urbanization as grouping variable

Performance Measure	Kruskal-Wallis H	df	sig.
Basic Skills Progress	4.689	3	0.196
Credit English Success	6.751	3	0.080
Credit Math Success	5.692	3	0.128
First Year Progression	9.615	3	0.022*
Curriculum Completion	5.623	3	0.131
Transfer Performance	4.789	3	0.188
Licensure Pass Rate	8.462	3	0.037*

* significant at the $p < 0.05$ level

Follow-up tests were conducted to evaluate pairwise differences among the four groups,

controlling for Type I error across tests by using the Holm's sequential Bonferroni approach

(Abdi, 2010). Results of the follow-up Mann-Whitney U tests for the first year progression measure are presented in Table 4.8.

Table 4.8.

First Year Progression Mann-Whitney U test with Holm's sequential Bonferroni approach on modified degree of urbanization

Modified degree of urbanization	Mann-Whitney U	p	Holm-Bonferroni p
Rural / City	50.000	.006	0.036*
Rural / Suburb	53.500	.046	0.230
Rural / Town	117.000	.084	-[a]
Town / City	60.000	.178	-[a]
Town / Suburb	58.500	.452	-[a]
Suburb / City	42.500	.603	-[a]

[a]: Not calculated as prior Holm-Bonferroni p-value was not significant.
* significant at the $p < 0.05$ level

The results of the tests summarized in Table 4.8 indicate a significant difference in first year progression between community colleges located in rural areas and those located within a city. NC community colleges located in Rural areas have a statistically significant higher first year progression mean rank in comparison to those located within cities. This means that typically, colleges located in a rural area will have higher proportion of students making progress in their first year than will colleges located within cities.

Results of the follow-up Mann-Whitney U tests for the licensure pass rate measure are presented in Table 4.9.

Table 4.9.

Licensure pass rate Mann-Whitney U test with Holm's sequential Bonferroni approach on modified degree of urbanization

Modified degree of urbanization	Mann-Whitney U	p	Holm-Bonferroni p
Town / City	37.000	0.011	0.066
Rural / City	57.000	0.014	-[a]
Suburb / City	32.500	0.201	-[a]
Town / Suburb	50.000	0.229	-[a]
Rural / Suburb	72.000	0.254	-[a]
Rural / Town	171.000	0.895	-[a]

[a]: Not calculated as prior Holm-Bonferroni p-value was not significant.

Only a single Holm-Bonferroni p-value was calculated. The Holm's sequential Bonferroni approach reduces the compounding of Type I error in performing multiple pairwise comparisons. Under the Holm's sequential Bonferroni approach, once a single non-significant p-value is obtained, further p-values are not explored as they will have larger values. The results of the tests summarized in Table 4.9 indicate no significant difference in licensure pass rate between community colleges based on their modified degree of urbanization. This result contradicts the Kruskal-Wallis test which found a difference between community colleges based on their modified degree of urbanization. This means that while the type of urban setting in which a community college is located has an impact on licensure pass rate, the exact nature of the impact is unclear.

Majority minority. A Kruskal-Wallis test was conducted to evaluate differences among the majority minority categories (majority minority school, not a majority minority school) on

median performance in each of the NC community college performance measures. The test, which was corrected for tied ranks, was significant for the basic skills progress ($\chi^2(1, 58) = 5.235$, $p = 0.022$); credit math success ($\chi^2(1, 58) = 4.003$, $p = 0.045$); and licensure pass rate ($\chi^2(1, 58) = 4.372$, $p = 0.037$) measures. As the majority minority status variable has only two categories, follow-up tests are not indicated. The Kruskal-Wallis tests show that community colleges in NC that are majority minority institutions have lower median scores on the basic skills progress, credit math success, and licensure pass rate performance measures. In other words, students at majority minority institutions are not as successful at improving basic skills, passing credit-bearing math courses, and passing state mandated licensure tests. The test was not significant for any other performance measure (see Table 4.10).

Table 4.10.

North Carolina Community College Performance Measures Kruskal-Wallis test with majority minority status as grouping variable

Performance Measure	Kruskal-Wallis H	df	sig.
Basic Skills Progress	5.235	1	0.022*
Credit English Success	2.010	1	0.156
Credit Math Success	4.003	1	0.045*
First Year Progression	0.068	1	0.794
Curriculum Completion	2.452	1	0.117
Transfer Performance	0.600	1	0.439
Licensure Pass Rate	4.372	1	0.037*

* significant at the $p < 0.05$ level

Proportion of students reported as female. Graphical analysis and simple linear regression were used to determine if there was a linear relationship between the proportion of students reported as female and each of the NC community college performance measures. Results, available in Appendix D, indicate no linear relationship. This means that a Kendall's τ_b test was appropriate to determine the relationship between the proportion of students reported as female and each of the NC community college performance measures. There was a significant moderate positive correlation between credit first year progression and the proportion of students reported as female ($\tau_b = 0.357$, $p = 0.003$). There was a significant moderate negative correlation between licensure pass rate and the proportion of students reported as female ($\tau_b = -0.299$, $p = 0.011$). These results indicate that as the proportion of female students increases, the performance on the first year progression measure tends to also increase and the results of the licensure pass rate measure tend to decrease. The results, displayed in table 4.11, do not indicate a significant correlation between any of the remaining performance measures and the proportion of students reported as female.

Table 4.11.

Kendall's τ_b correlation between North Carolina Community College performance measures and proportion of students reported as female

Performance Measure	Kendall's τ_b	p
Basic Skills Progression	0.005	0.486
Credit English Success	-0.074	0.297
Credit Math Success	-0.083	0.268
First Year Progression	0.0357	0.003*
Curriculum Completion	0.138	0.151
Transfer Success	-0.060	0.326
Licensure Pass Rate	-0.299	0.011*

* significant at the $p < 0.05$ level

College size. Graphical analysis and simple linear regression were used to determine if there was a linear relationship between the total number of students reported and each of the NC community college performance measures. Results, available in Appendix E, indicate no linear relationship. This means that a Kendall's τ_b test was appropriate to determine the relationship between the number of students and each of the NC community college performance measures. There was a significant moderate negative correlation between credit first year progression and the number of students ($\tau_b = -0.237, p = 0.036$). There was a significant moderate negative correlation between curriculum completion and the number of students ($\tau_b = -0.360, p = 0.003$). There was a significant moderate positive correlation between licensure pass rate and the number of students ($\tau_b = 0.371, p = 0.002$). These results indicate that as the number of students increases, the performance on the first year progression and curriculum completion measures

tend to decrease, and the results of the licensure pass rate measure tend to increase. The results, displayed in Table 4.12, do not indicate a significant correlation between any of the remaining performance measures and the proportion of students reported as female.

Table 4.12.

Kendall's τ_b correlation between North Carolina Community College performance measures and total number of students

Performance Measure	Kendall's τ_b	p
Basic Skills Progression	-0.203	0.063
Credit English Success	0.011	0.468
Credit Math Success	-0.051	0.353
First Year Progression	-0.237	0.036*
Curriculum Completion	-0.360	0.003*
Transfer Success	0.152	0.127
Licensure Pass Rate	0.371	0.002**

* significant at the $p < 0.05$ level
** significant at the $p < 0.01$ level

The total students variable was reclassified as either small (fewer than 1,000 students); medium (between 1,000 and 4,999 students); large (between 5,000 and 9,999 students); or extra-large (10,000 or more students). A Kruskal-Wallis test was conducted to evaluate differences among the college size categories (small, medium, large, and extra-large) on median performance in each of the NC community college performance measures. The test, which was corrected for tied ranks, was significant for the credit English success ($\chi^2(3, 58) = 9.267$, $p = 0.026$); first year progression ($\chi^2(3, 58) = 10.475$, $p = 0.015$); and curriculum completion ($\chi^2(3,$

58) = 12.431, $p = 0.006$) measures. This means that the size of the community college has an impact on credit English success, first year progression, and curriculum completion. Follow up tests will explore the impact in more detail. The test was not significant for any other performance measure (see Table 4.13).

Table 4.13.

North Carolina Community College Performance Measures Kruskal-Wallis test with college size as grouping variable

Performance Measure	Kruskal-Wallis H	df	sig.
Basic Skills Progress	6.480	3	0.090
Credit English Success	9.267	3	0.026*
Credit Math Success	4.442	3	0.217
First Year Progression	10.475	3	0.015*
Curriculum Completion	12.431	3	0.006**
Transfer Performance	0.047	3	0.997
Licensure Pass Rate	4.053	3	0.256

* significant at the $p < 0.05$ level
** significant at the $p < 0.01$ level

Follow-up tests were conducted to evaluate pairwise differences among the four groups, controlling for Type I error across tests by using the Holm's sequential Bonferroni approach (Abdi, 2010). Results of the follow-up Mann-Whitney U tests for the credit English success measure are presented in Table 4.14.

Table 4.14.

Credit English success Mann-Whitney U test with Holm's sequential Bonferroni approach on college size

College Size	Mann-Whitney U	p	Holm-Bonferroni p
Small / Medium	24.000	0.003	0.018*
Small / Large	8.000	0.093	0.465
Medium / Large	119.500	0.234	-ᵃ
Medium / Extra Large	53.000	0.267	-ᵃ
Small / Extra Large	6.000	0.413	-ᵃ
Large / Extra Large	15.000	0.933	-ᵃ

a: Not calculated as prior Holm-Bonferroni *p*-value was not significant.
* significant at the $p < 0.05$ level

The results of the tests summarized in Table 4.14 indicate a significant difference in credit English success between small and medium sized colleges. Small (fewer than 1,000 students) NC community colleges have a lower mean credit English success rank in comparison to medium (between 1,000 and 4,999 students) community colleges in NC. An additional follow-up test was performed comparing small community colleges to all other community colleges. A Mann-Whitney U test ($U = 38.000$, $p = 0.006$) indicated that the credit English success performance was higher for colleges with 1,000 or more students (median = 63.7%) than for colleges with less than 1,000 students (median = 50.8%).

Results of the follow-up Mann-Whitney U tests for the first year progression success measure are presented in Table 4.15.

Table 4.15.

First year progression success Mann-Whitney U test with Holm's sequential Bonferroni approach on college size

College Size	Mann-Whitney U	p	Holm-Bonferroni p
Small / Medium	34.000	0.013	0.078
Small / Large	5.000	0.030	-[a]
Small / Extra Large	1.000	0.032	-[a]
Medium / Large	104.000	0.109	-[a]
Medium / Extra Large	45.000	0.150	-[a]
Large / Extra Large	12.000	0.570	-[a]

a: Not calculated as prior Holm-Bonferroni *p*-value was not significant.

The results of the tests summarized in Table 4.15 indicate no significant difference in first year progression between community colleges based on their size. This result contradicts the Kruskal-Wallis test that showed the differences between colleges of differing sizes was significant. An additional follow-up test was performed comparing small community colleges to all other community colleges. A Mann-Whitney U test ($U = 38.000$, $p = 0.006$) indicated that first year progression performance was lower for colleges with 1,000 or more students (median = 67.7%) than for colleges with fewer than 1,000 students (median = 76.4%). The test also proved significant when bifurcating the data into Small/Medium and Large/Extra Large groups. A Mann-Whitney U test ($U = 40.000$, $p = 0.008$) indicated that the first year progression performance was lower for colleges with 5000 or more students (median = 66.25%) than for colleges with fewer than 5000 students (median = 68.85%).

Results of the follow-up Mann-Whitney U tests for the curriculum completion success

measure are presented in Table 4.16.

Table 4.16.

Curriculum Completion Mann-Whitney U test with Holm's sequential Bonferroni approach on college size

College Size	Mann-Whitney U	p	Holm-Bonferroni p
Medium / Extra Large	16.000	0.005	0.03*
Medium / Large	74.500	0.013	0.065
Small / Extra Large	2.000	0.063	-[a]
Small / Large	9.000	0.127	-[a]
Large / Extra Large	8.500	0.214	-[a]
Small / Medium	77.500	0.389	-[a]

[a]: Not calculated as prior Holm-Bonferroni *p*-value was not significant.
* significant at the $p < 0.05$ level

The results of the tests summarized in Table 4.16 indicate a significant difference in

curriculum completion between medium (1,000 to 4,999 students) and extra-large (10,000 or

more students) community colleges. An additional follow-up test was performed comparing

extra-large community colleges to all other community colleges. A Mann-Whitney U test ($U =$

38.000, $p = 0.006$) indicated that the curriculum completion performance was lower for colleges

with 10,000 or more students (median = 43.15%) than for colleges with fewer than 10,000

students (median = 49.75%). The test also proved significant when bifurcating the data into

Small/Medium and Large/Extra Large groups. A Mann-Whitney U test ($U = 26.500$, $p = 0.008$)

indicated that the first year progression performance was lower for colleges with 5000 or more students (median = 66.25%) than for colleges with fewer than 5000 students (median = 68.85%).

Proportion of students receiving Pell grants. Graphical analysis and simple linear regression were used to determine if there was a linear relationship between the proportion of students receiving Pell and each of the NC community college performance measures. Results, available in Appendix F, indicate no linear relationship. This means that a Kendall's τ_b test was appropriate to determine the relationship between the proportion of students classified as first-time and each of the NC community college performance measures. The results, displayed in Table 4.17, do not indicate a significant correlation between any of the performance measures and the proportion of students receiving Pell grants.

Table 4.17.

Kendall's τ_b correlation between North Carolina Community College performance measures and proportion of students receiving Pell grants

Performance Measure	Kendall's τ_b	p
Basic Skills Progression	-0.199	0.067
Credit English Success	0.094	0.241
Credit Math Success	-0.200	0.066
First Year Progression	0.086	0.261
Curriculum Completion	-0.090	0.251
Transfer Success	-0.213	0.054
Licensure Pass Rate	-0.072	0.295

The proportion of students receiving the Pell grant was then recoded into a categorical variable. Colleges with 33% or fewer students receiving the Pell grant were classified as low Pell. Colleges with more than 50% of students receiving Pell were classified as high Pell colleges. All other colleges, those with between 34% and 50% of students receiving Pell were classified as medium Pell colleges. These ranges of values were chosen to more closely align with how students are classified by Carnegie and to ensure that each grouping had more than 5 colleges within the group. A Kruskal-Wallis test was conducted to evaluate differences among the college Pell award categories (low, medium, and high) on median performance in each of the NC community college performance measures. The test, which was corrected for tied ranks, was significant for the credit English success (χ^2(2, 58) = 6.402, p = 0.041) and the credit Math success (χ^2(2, 58) = 6.441, p = 0.040) measures. This means that the proportion of students receiving Pell grants does have an impact on the college's performance in Math and English courses. Follow-up testing is needed to better understand this impact. The test was not significant for any other performance measure (see Table 4.18).

Table 4.18.

North Carolina Community College Performance Measures Kruskal-Wallis test with Pell award categories as grouping variable

Performance Measure	Kruskal-Wallis H	df	sig.
Basic Skills Progress	2.806	2	0.246
Credit English Success	6.402	2	0.041*
Credit Math Success	6.441	2	0.040*
First Year Progression	1.322	2	0.516
Curriculum Completion	0.427	2	0.808
Transfer Performance	4.984	2	0.083
Licensure Pass Rate	1.819	2	0.403

* significant at the $p < 0.05$ level

Follow-up tests were conducted to evaluate pairwise differences among the three groups of low, medium, and high proportion of Pell Grant recipients, controlling for Type I error across tests by using the Holm's sequential Bonferroni approach (Abdi, 2010). Results of the follow-up Mann-Whitney U tests for the credit English success measure are presented in Table 4.19.

Table 4.19

Credit English success Mann-Whitney U test with Holm's sequential Bonferroni approach on Pell award category

College Size	Mann-Whitney U	p	Holm-Bonferroni p
Low / Medium	100.000	0.026	0.078
Low / High	29.000	0.072	-[a]
Medium / High	149.500	0.185	-[a]

a: Not calculated as prior Holm-Bonferroni p-value was not significant.

The results of the tests summarized in Table 4.19 indicate no significant difference in credit English success between community colleges based on the proportion of students receiving Pell. This result contradicts the Kruskal-Wallis test that showed the differences between colleges with differing Pell proportions was significant. Note that the sequential ordering of Pell proportions based on *p*-values shows colleges with a low percentage of Pell students listed first. This information along with the conflicting test results indicate the need for additional testing. An additional follow-up test was performed comparing community colleges with a low Pell proportion to all other community colleges. A Mann-Whitney *U* test ($U = 129.000$, $p = 0.022$) indicated that the credit English success was lower for colleges with less than 33% of students receiving Pell (median = 54.85%) than for colleges with more than 33% of students receiving Pell (median = 63.9%). In other words, colleges with lower proportion of students receiving Pell grants had statistically significant lower success in college English courses.

Results of the follow-up Mann-Whitney *U* tests for the credit Math success measure are presented in Table 4.20.

Table 4.20

Credit Math success Mann-Whitney U test with Holm's sequential Bonferroni approach on Pell award category

College Size	Mann-Whitney *U*	*p*	Holm-Bonferroni *p*
Medium / High	110.500	0.023	0.069
Low / Medium	130.000	0.159	-[a]
Low / High	38.000	0.251	-[a]

a: Not calculated as prior Holm-Bonferroni *p*-value was not significant.

The results of the tests summarized in Table 4.20 indicate no significant difference in credit Math success between community colleges based on the proportion of students receiving Pell Grant funding. This result contradicts the Kruskal-Wallis test that showed the differences between colleges of with differing Pell proportions was significant. Note that the sequential ordering of Pell proportions based on p-values shows colleges with a medium percentage of Pell students listed first. This information along with the conflicting test results indicate the need for additional testing. An additional follow-up test was performed comparing community colleges with a medium (more than 33% and less than or equal to 50%) Pell proportion to all other community colleges. A Mann-Whitney test ($U = 240.500, p = 0.017$) indicated that the credit Math success was higher for colleges with a medium proportion of Pell students (median = 43.6%) than for colleges with less than 33% of students or more than 50% receiving Pell (median = 35.6%). This counterintuitive result indicates that college with a low or high proportion of students receiving Pell grants do not perform as well on the college Math success metric.

Proportion of students classified as first-time. Graphical analysis and simple linear regression were used to determine if there was a linear relationship between the proportion of students classified as first-time and each of the NC community college performance measures. Results, available in Appendix G, indicate no linear relationship. This means that a Kendall's τ_b test was appropriate to determine if there is a relationship between the proportion of students classified as first-time and each of the NC community college performance measures. The results, displayed in Table 4.21, do not indicate a significant correlation between any of the performance measures and the proportion of students classified as first-time.

Table 4.21.

Kendall's τ_b correlation between North Carolina Community College performance measures and proportion of students classified as first-time

Performance Measure	Kendall's τ_b	p
Basic Skills Progression	0.059	0.255
Credit English Success	0.068	0.224
Credit Math Success	-0.004	0.481
First Year Progression	0.001	0.495
Curriculum Completion	0.055	0.273
Transfer Success	-0.103	0.128
Licensure Pass Rate	0.013	0.444

Proportion of students classified as full-time. Graphical analysis and simple linear regression were used to determine if there was a linear relationship between the proportion of students classified as full-time and each of the NC community college performance measures. Results, available in Appendix H, indicate no linear relationship. This means that a Kendall's τ_b test was appropriate to determine the relationship between the proportion of students classified as full-time and each of the NC community college performance measures. There was a weak positive correlation between credit English success and the proportion of students classified as full-time ($\tau_b = 0.175$, $p = 0.026$). There was a weak negative correlation between first year progression and the proportion of students classified as full-time ($\tau_b = -0.160$, $p = 0.038$). These results indicate that as the proportion of students classified as full-time increases, the performance on the credit English success measure tends to increase, and performance on the first year progression measure tends to decrease. In other words, institutions with a larger

proportion of full0time students tend to do better on English success performance but less well on first year progression measures. The results, displayed in Table 4.22, do not indicate a significant correlation between any of the remaining performance measures and the proportion of students classified as first-time.

Table 4.22.

Kendall's τ_b correlation between North Carolina Community College performance measures and proportion of students classified as full-time

Performance Measure	Kendall's τ_b	p
Basic Skills Progression	0.004	0.484
Credit English Success	0.175	0.026*
Credit Math Success	0.106	0.120
First Year Progression	-0.160	0.038*
Curriculum Completion	-0.052	0.282
Transfer Success	-0.135	0.067
Licensure Pass Rate	0.042	0.321

* significant at the $p < 0.05$ level

Proportion of students classified as full-time, first-time. Graphical analysis and simple linear regression were used to determine if there was a linear relationship between the proportion of students classified as full-time, first-time and each of the NC community college performance measures. Results, available in Appendix I, indicate no linear relationship. This means that a Kendall's τ_b test was appropriate to determine the relationship between the proportion of students classified as first-time and each of the NC community college performance measures. The

results, displayed in Table 4.23, do not indicate a significant correlation between any of the

performance measures and the proportion of students classified as full-time, first-time.

Table 4.23.

Kendall's τ_b correlation between North Carolina Community College performance measures and proportion of students classified as full-time, first-time

Performance Measure	Kendall's τ_b	p
Basic Skills Progression	0.044	0.315
Credit English Success	0.135	0.067
Credit Math Success	0.045	0.307
First Year Progression	-0.008	0.463
Curriculum Completion	0.118	0.097
Transfer Success	-0.066	0.232
Licensure Pass Rate	0.047	0.302

Proportion of students classified as transfer. Graphical analysis and simple linear

regression were used to determine if there was a linear relationship between the proportion of

students classified as transfer and each of the NC community college performance measures.

Results, available in Appendix J, indicate no linear relationship. This means that a Kendall's τ_b

test was appropriate to determine the relationship between the proportion of students classified as

first-time and each of the NC community college performance measures. The results, displayed

in Table 4.24, do not indicate a significant correlation between any of the performance measures

and the proportion of students classified as full-time, first-time.

Table 4.24.

Kendall's τ_b correlation between North Carolina Community College performance measures and proportion of students classified transfer

Performance Measure	Kendall's τ_b	p
Basic Skills Progression	-0.117	0.098
Credit English Success	-0.084	0.177
Credit Math Success	0.002	0.489
First Year Progression	-0.026	0.386
Curriculum Completion	-0.140	0.061
Transfer Success	-0.038	0.339
Licensure Pass Rate	0.110	0.116

Proportion of students classified as continuing. Graphical analysis and simple linear regression were used to determine if there was a linear relationship between the proportion of students classified as continuing and each of the NC community college performance measures. Results, available in Appendix K, indicate no linear relationship. This means that a Kendall's τ_b test was appropriate to determine the relationship between the proportion of students classified as continuing and each of the NC community college performance measures. There was a moderate negative correlation between curriculum completion and the proportion of students classified as continuing ($\tau_b = 0.246$, $p = 0.003$). This means that as the proportion of students classified as continuing increases, the success on the curriculum completion performance measure tends to decrease. In other words, NC community colleges with higher levels of continuing students tend to not do as well on curriculum completion measures. The results, displayed in Table 4.25, do

not indicate a significant correlation between any of the remaining performance measures and

the proportion of students classified as continuing.

Table 4.25.

Kendall's τ_b correlation between North Carolina Community College performance measures and proportion of students classified continuing

Performance Measure	Kendall's τ_b	p
Basic Skills Progression	0.001	0.495
Credit English Success	0.005	0.476
Credit Math Success	0.015	0.433
First Year Progression	-0.132	0.072
Curriculum Completion	-0.246	0.003**
Transfer Success	-0.125	0.084
Licensure Pass Rate	0.051	0.288

* significant at the $p < 0.01$ level

Proportion of students classified as non-degree/certificate seeking. Graphical

analysis and simple linear regression were used to determine if there was a linear relationship

between the proportion of students classified as non-degree/certificate seeking and each of the

NC community college performance measures. Results, available in Appendix L, indicate no

linear relationship. This means that a Kendall's τ_b test was appropriate to determine the

relationship between the proportion of students classified as non-degree/certificate seeking and

each of the NC community college performance measures. There was a weak positive correlation

between curriculum completion and the proportion of students classified as non-

degree/certificate seeking ($\tau_b = 0.205$, $p = 0.012$). This means as the proportion of students classified as non-degree/certificate seeking increases the curriculum completion success measure also tends to increase. The results, displayed in table 4.26, do not indicate a significant correlation between any of the remaining performance measures and the proportion of students classified as non-degree/certificate seeking.

Table 4.26.

Kendall's τ_b correlation between North Carolina Community College performance measures and proportion of students classified non-degree/certificate seeking

Performance Measure	Kendall's τ_b	p
Basic Skills Progression	-0.029	0.374
Credit English Success	0.007	0.471
Credit Math Success	-0.026	0.386
First Year Progression	0.103	0.127
Curriculum Completion	0.205	0.012*
Transfer Success	0.145	0.54
Licensure Pass Rate	-0.054	0.279

* significant at the $p < 0.01$ level

Proportion of instructional staff that are part-time. Graphical analysis and simple linear regression were used to determine if there was a linear relationship between the proportion of instructional staff classified as part-time and each of the NC community college performance measures. Results, available in Appendix M, indicate no linear relationship. This means that a Kendall's τ_b test was appropriate to determine the relationship between the proportion of instructional staff classified as part-time and each of the NC community college performance

measures. The results, displayed in Table 4.27, do not indicate a significant correlation between

any of the performance measures and the proportion of instructional staff classified as part-time.

Table 4.27.

Kendall's τ_b correlation between North Carolina Community College performance measures and proportion of instructional staff classified as part-time

Performance Measure	Kendall's τ_b	p
Basic Skills Progression	-0.011	0.452
Credit English Success	-0.009	0.460
Credit Math Success	-0.007	0.471
First Year Progression	0.042	0.319
Curriculum Completion	0.133	0.070
Transfer Success	-0.010	0.455
Licensure Pass Rate	-0.070	0.224

County economic tier. Graphical analysis and simple linear regression were used to

determine if there was a linear relationship between the county economic tier and each of the NC

community college performance measures. Results, available in Appendix N, indicate no linear

relationship. A Kendall's τ_b, was run to determine the relationship between the proportion of

students classified as non-degree/certificate seeking and each of the NC community college

performance measures. There was a moderate positive correlation between the county economic

tier ($\tau_b = 0.349$, $p < 0.001$). These results indicate that as country economic tier increases,

success on the licensure pass rate measure tends to increase also. In other words, NC community

colleges serving less economically distressed counties have a higher licensure pass rate. The

results, displayed in Table 4.28, do not indicate a significant correlation between any of the

remaining performance measures and the proportion of students classified as first-time.

Table 4.28.

Kendall's τ_b correlation between North Carolina Community College performance measures and county economic tier

Performance Measure	Kendall's τ_b	p
Basic Skills Progression	-0.035	0.359
Credit English Success	0.121	0.109
Credit Math Success	0.108	0.135
First Year Progression	-0.047	0.316
Curriculum Completion	0.016	0.437
Transfer Success	0.141	0.076
Licensure Pass Rate	0.349	***

*** significant at the $p < 0.001$ level

Conclusion

The purpose of this research was to identify to explore whether the construction of the

NC Performance Measures provides an equitable measure of performance and whether

institutional characteristics impact a college's ability to meet performance standards.

Quantitative analyses were performed using key metrics of success as defined by the NC

community college performance measures as dependent variables. Independent variables

included institutional which are publicly available and comes from two primary sources, the NC

and the Integrated Postsecondary Education Data System.

The following research questions are addressed:

1. Are the data used to determine baseline and excellence levels for the North Carolina community colleges performance measures normally distributed?

2. What is the relationship between institutional characteristics and the performance of community colleges as measured by the North Carolina community college performance measures?

Testing showed a variety of results with three of the NC community college performance measures coming from non-normal distributions. All but one of the performance measures had a significant finding in relation to at least one institutional characteristic.

Basic Skills progress. The basic skills progress performance measure showed significant ($p = 0.022$) correlation with the variable majority minority. This means that community colleges in NC with a population of students that is classified as majority minority underperform on basic skills progress when compared to other community colleges in NC. This is the only institutional characteristic test that showed an impact on the basic skills progress measure.

Credit English success. The credit English success performance measure showed significant correlation with the variables college size ($p = 0.018$), Pell category ($p = 0.022$), and the proportion of students classified as full-time ($p = 0.026$). The testing shows community colleges in NC with fewer than 1,000 students (median = 50.8%) have less success than those with more than 1,000 students (median = 63.7%). Also shown, community colleges with fewer Pell recipients (less than 33%) have a lower (median = 54.85%) proportion of students earning college English credit than schools with more Pell students (median = 63.9%). The proportion of students classified as full-time was also shown to have a weak negative correlation with the credit English success measure ($p = 0.026$). As the proportion of full-time students increases, the success on the credit English success measure tends to decrease.

Credit Math success. The credit Math success performance measure showed significant correlation with the variables of majority minority ($p = 0.045$) and Pell student category ($p = 0.017$). The testing shows that NC community colleges classified as majority minority have lower success (median = 35.55%) on the credit math success measure than other community colleges (median = 43.35%). Testing also indicated that credit Math success was higher for colleges with a 33% to 49% of students receiving Pell (median = 43.6%) than for colleges with less than 33% of students or more than 50% receiving Pell (median = 35.6%).

First year progression. The first year progression performance measure showed significant correlation with the variables of modified degree of urbanization ($p = 0.036$), proportion of students reported as female ($p = 0.003$), college size ($p = 0.006$), and proportion of students classified as full-time ($p = 0.038$). Additionally, a Shapiro-Wilk (W(58) = 0.949, p = 0.017) indicates that the first year progression success measure is not normally distributed. This is supported by the kurtosis value of 1.78 which indicates a leptokurtic distribution and not a normal distribution.

The lack of a normal distribution indicates that the use of performance benchmarks one and two standard deviations away from the mean may not be appropriate and could disadvantage institutions as they try to meet state benchmarks. The data is shown to be impacted by the degree of urbanization, with institutions in a rural location performing better than those located in a city. The size of the college also has an impact on first year progression. Smaller (fewer than 1000 students) colleges tend to perform better (median = 76.4%) on the first year progression measure than larger colleges (median = 67.7%). The proportion of students classified as full-time has a weak negative correlation on first year progression. This means that as the proportion of full-time students increases, performance on the first year progression measure tends to decline.

Curriculum completion. The curriculum completion performance measure showed significant correlation with the variables of number of students (p = 0.003), college size (p = 0.006), proportion of students classified as continuing (p = 0.003), and proportion of students classified as non-degree/certificate seeking (p = 0.012). Testing showed a moderate negative correlation between the number of students and the curriculum completion measure. This means that as the number of students increases, the curriculum completion metric tends to decrease. This was further seen when comparing colleges with 10,000 or more students (median = 43.15%) to smaller colleges (median = 49.75%) on the curriculum completion measure. In addition to college size, the type of students also had an impact. The proportion of students classified as continuing has a moderate negative correlation with curriculum completion. As the proportion of students classified as continuing increases, the curriculum completion metric tends to decrease. This is opposite of the weak positive correlation found with the proportion of students classified as non-degree/certificate seeking. As the proportion of non-degree/certificate seeking students increases, the curriculum completion rate tends to increase.

Transfer performance. The transfer performance success measure did not show a significant correlation with any of the institutional characteristics studied. A Shapiro-Wilk test showed a significant departure from normality (W(58) = 0.939, p = 0.006). Other measures of the distribution showed similar results. The skewness value of the transfer performance data is -1.097. This indicates that the data is highly negatively skewed, meaning the data has a few large values pulling the mean transfer performance score lower than the median score. A kurtosis value of 3.293 also indicates a leptokurtic distribution with a few values contributing greatly the variance. Both the skewness and kurtosis values point to data that are not normally distributed. The lack of a normal distribution indicates that the use of performance benchmarks 1 and 2

standard deviations away from the mean may not be appropriate and could disadvantage institutions as they try to meet state benchmarks.

Licensure pass rate. The licensure pass rate performance measure showed significant correlation with the variables modified degree of urbanization ($p = 0.036$), majority minority ($p = 0.037$), proportion of students reported as female ($p = 0.011$), number of students ($p = 0.002$) and county economic tier ($p < 0.001$). A Shapiro-Wilk test showed a significant departure from normality (W(58) = 0.921, p = 0.001). Other measures of the distribution showed similar results. The skewness value of the licensure pass rate data is -1.196. This indicates that the data is highly negatively skewed, meaning the data has a few large values pulling the mean licensure pass rate score lower than the median score. A kurtosis value of 4.105 also indicates a leptokurtic distribution with a few values contributing greatly the variance. Both the skewness and kurtosis values point to data that are not normally distributed. The lack of a normal distribution indicates that the use of performance benchmarks 1 and 2 standard deviations away from the mean may not be appropriate and could disadvantage institutions as they try to meet state benchmarks.

Testing on the modified degree of urbanization showed the differences community colleges with different degree of urbanization classifications was significant. However, follow-up tests were unable to more clearly identify the pairwise correlations. This means that while the type of setting (rural, suburban, or urban) in which a community college is located has an impact on licensure pass rate, the exact nature of the impact is unclear. This may be in part due to the impact of the number of students which showed a moderately positive correlation. This indicates that as the number of students increases, which is likely as you move from rural to a city setting, the licensure pass rate performance also tends to increase. Also seen was a weak negative correlation with the proportion of students classified as female. As the proportion of female

students increases, the licensure pass rate score tends to decrease. The majority minority status of the community college also has an impact on licensure pass rate, with majority minority institutions having a lower licensure pass rate (median = 0.950) than other institutions (median = 0.995).

Licensure pass rate was the only performance measure that showed a correlation with the county economic tier variable. The moderate positive correlation indicates that as the economic tier increases, the licensure pass rate also tends to increase. In other words, colleges located in more affluent areas tend to have higher licensure pass rates.

Institutional characteristics. A total of 18 institutional characteristics were analyzed for this study. The characteristics were chosen from readily available data in order to show that adjustments to the current performance measure system in NC could be made without procuring new or difficult to obtain data. Of the institutional characteristics, 10 were found to have an impact on the performance measures. The institutional characteristics found to impact at least one of the NC community college performance measures are summarized in Table 4.29.

Table 4.29.

Institutional characteristics with an impact on a North Carolina community college performance measure

Institutional Characteristic	Performance Measure Impacted
Modified degree of urbanization	First year progression Licensure pass rate
Majority minority	Basic skills progress Credit Math success Licensure pass rate
Proportion of students classified as female	First year progression Licensure pass rate
Number of students	First year progression Curriculum completion Licensure pass rate
College size	Credit English success First year progression Curriculum completion
Pell category	Credit English success Credit Math success
Proportion of students classified as full-time	Credit English success First year progression
Proportion of students classified as continuing	Curriculum completion
Proportion of students classified as non-degree/certificate seeking	Curriculum completion
County economic tier	Licensure pass rate

These results indicate multiple institutional characteristics have a significant impact on the NC community college performance measures. The identified impact contributes to the inability of some community colleges to meet state performance goals. For example, Bladen,

Edgecombe, Halifax, James Sprunt, Martin, and Roanoke-Chowan community colleges are classified as majority minority and are located in rural areas. Additionally, these colleges each have less than 3,000 students and serve counties in the lowest economic tier. For these colleges, the four institutional characteristics (majority minority, modified degree of urbanization, college size, and county economic tier) all indicate the institutions will perform lower on six of the seven performance measures (first year progression, licensure pass rate, basic skills progress, college Math success, college English success, and curriculum completion). By examining institutional characteristics found in readily available data, the NCCCS can redefine the state performance measures in a way that more equitably measures the success of students. Additionally, these results point to the need for a new method of determining baseline and excellence levels across the state. These changes are necessary to ensure that students have access to quality information about community college performance, legislators have accurate information to inform accountability decisions, and educators have information that can help lead to improvement.

This research focuses on the construction of the North Carolina Community College System Performance Measures and whether they provide an equitable measure of performance. The research specifically focuses on whether institutional characteristics impact a college's ability to meet performance standards. Statistical analyses show that six of the seven performance measures (basic skill progress, transfer success, curriculum completion, college English success, college Math success, and licensure pass rate) were impacted by institutional characteristics. The next chapter discusses the implications of these findings and makes recommendations for changes to the process used in North Carolina to assess community colleges in the state-wide system.

CHAPTER 5: DISCUSSIONS AND SUGGESTIONS FOR FUTURE RESEARCH

The current system of performance measures for NC community colleges provides a snapshot of the quality of community colleges across the state. The current performance measure system is comprised of seven measures, basic skills progress, credit English success, credit Math success, first year progression, curriculum completion, transfer performance, and licensure pass rate. The NC state board of community colleges identifies the system average along with baseline and excellence levels for each measure. Additional operating funds are then provided to each community college based on their performance on the measures. The focus of this research is on the definition and construction of the measures. This study examines potential biases hidden by how the data are calculated and reported.

The construction of each measure is examined in Appendix A. This examination identifies concerns with the construction of the measures. Some such concerns are the lack of representation of the full student body and the determination of excellence levels where less than half of the students measured are successful. While the reporting of benchmarks is problematic, as described in Appendix A, there are other considerations in the construction of system-wide quality measures that may point to inequities that disadvantage particular institutions because of size, population, or individual mission. Analyzing the construction of performance measures to better understand the underlying assumption of normality and to identify bias in the construction of the measures, may lead to a more fair, meaningful, and useful approach to understanding student success measures for community colleges.

The North Carolina Community College System (NCCCS) is comprised of 58 unique community colleges created with the express purpose of serving their local communities ranging from large urban areas to small rural coastal and mountain areas. The differences found in the

community colleges highlight their ability to adapt to serve their communities as one of their defining strengths but calls into question the use of a one-size-fits-all comparison of institutions.

While mandated by the state to create an accountability system that allows colleges to be compared for a variety of purposes including additional funding, the current one-size-fits-all system that applies equally to all colleges appears to conflict with the spirit of individuality behind each community college serving local needs and constituents. As shown in Appendix A, dual-enrolled and high school students Advanced Placement (AP) credit are not included within the credit Math and credit English success measures. The basic skills success measure identified nine community colleges as meeting the level of excellence, with between 51% and 59% of basic skills students showing measurable skills gains. Whereas Roanoke-Chowan scored the lowest in this measure with only 13.5% of their basic skills students showing a measurable skills gain. However, while showing the most need for improvement in student success, Roanoke-Chowan was awarded approximately $13.84 per basic skills student based on the success measure (NCCCSa, 2018). The nine colleges denoted as excellent were awarded approximately $177.40 per basic skills student. The establishment of benchmarks and approaches to defining excellence and needed improvement categories are highly problematic both mathematically and in the service of supporting students (see Appendix A).

The purpose of this study was the exploration of institutional characteristics and their impact on the calculated success metrics defined by the NC community college system. Specific consideration was given to persistent systematic biases introduced through the mathematics of benchmarking and the assumption of normally distributed data. Institutional characteristics chosen for study were selected based on readily available data in an effort to show that currently

available data can be used to improve the definition of performance measures in NC community colleges.

Summary of Findings

North Carolina uses a system of seven performance measures applied to each of the 58 community colleges in the state. This one-size-fits-all approach to performance measurement conflicts with the purpose of community colleges, namely serving the communities in which they are located. As each community college serves a different county, or counties, the population of students within the college vary across the state. However, the measure of success remains the same for each of the community colleges, in effect creating an equity vs. equality dilemma surrounding the state mandated performance measures.

To investigate this problem, the following research questions are addressed to determine if the construction of the NC community college performance measures provides equitable measures of performance and whether institutional characteristics impact a college's ability to meet performance standards.

1. Are the data used to determine baseline and excellence levels for the North Carolina community colleges performance measures normally distributed?

2. What is the relationship between institutional characteristics and the performance of community colleges as measured by the North Carolina community college performance measures?

In answering the first question, analysis found that data sets for three of the performance measure did not come from a normal distribution. Transfer performance, licensure pass rate, and first year progression all failed the Shapiro-Wilk test ($p < 0.05$ for each) and have a kurtosis value indicating a leptokurtic distribution. This means that for these measures, community

college performance tends to be focused around the system average with a few colleges have extremely high or low success rates. This type of distribution indicates that the current practice of using standard deviation to determine baseline and excellence levels is not appropriate. Licensure pass rate and transfer performance data also have a skewness that indicates a highly negatively skewed distribution. This means that the majority of colleges perform at a level higher than the system average and a few institutions perform at much lower levels, effectively lowering the system average. As with the leptokurtic distribution, the presence of a negatively skewed distribution indicates that standard deviation should not be used to determine baseline and excellence levels.

For the second question, Kruskal-Wallis, Kendall's τ_b, and Mann-Whitney U tests were performed to identify potential relationships between the NC community college performance measures and a list of 18 independent variables representing institutional characteristics (see Table 3.3). For categorical dependent variables, a Kruskal-Wallis test was performed. This nonparametric test was used to determine if there was a statistically significant difference in success between independent variable groupings. When a statistically significant difference was identified, follow-up Mann-Whitney U tests were used to determine which categories of the independent variable had a statistically significant difference. For non-categorical dependent variables, Kendall's τ_b was calculated and analyzed. This test identifies the strength and direction of association that exists between to non-categorical variables. If the Kendall's τ_b test shows a statistically significant relationship it will suggest that changes in the independent institutional characteristic variable have an influence on changes to the dependent success measures.

Of the seven performance measures, six of them were found to have a significant ($p <$ 0.05) relationship with one of the independent variables (see Table 5.1). For these six

performance measures there is at least one institutional characteristic that has a correlation with success on the performance measure. The institutional characteristics represent attributes of the college outside of the control of the college, attributes that have a statistically significant impact of either increasing or decreasing performance on the measures. For example, shown in Table 5.1, the credit English success measure was shown to have a correlation with college size, Pell category, and the proportion of students categorized as full-time.

Table 5.1.

North Carolina community college performance measures influenced by institutional characteristics

Performance Measure Impacted	Institutional Characteristic
Basic skills progress	Majority minority
Credit English success	College size Pell category Proportion of students as full-time
Credit Math success	Majority minority Pell category
First year progression	Modified degree of urbanization Proportion of students as female Number of students College size Proportion of students as full-time
Curriculum completion	Number of students College size Proportion of students as continuing Proportion of students as non-degree/certificate seeking

Table 5.1 (Continued.)

Performance Measure Impacted	Institutional Characteristic
Transfer performance	No institutional characteristics found to have a significant correlation
Licensure pass rate	Modified degree of urbanization Majority minority Proportion of students as female Number of Students County Economic Tier

Seen from a different perspective, 18 institutional characteristics were examined and 10 were found to have a relationship with at least one of the performance measures (see Table 5.2). This implies that there are at least 10 institutional characteristics, determined from readily available data, for which statistically significant differences in NC community college performance measures can be identified. For example, as shown in Table 5.2, the proportion of students classified as female at an institution impacts both the first year progression and licensure pass rate measures.

Table 5.2.

Institutional characteristics with an impact on a North Carolina Community College Performance Measure

Institutional Characteristic	Performance Measure Impacted
Modified degree of urbanization	First year progression Licensure pass rate
Majority minority	Basic skills progress Credit Math success Licensure pass rate

Table 5.2 (Continued.)

Institutional Characteristic	Performance Measure Impacted
Proportion of students classified as female	First year progression Licensure pass rate
Number of students	First year progression Curriculum completion Licensure pass rate
College size	Credit English success First year progression Curriculum completion
Pell category	Credit English success Credit Math success
Proportion of students classified as full-time	Credit English success First year progression
Proportion of students classified as continuing	Curriculum completion
Proportion of students classified as non-degree/certificate seeking	Curriculum completion
County economic tier	Licensure pass rate

Placing these results in the context of the research questions posed yields the following answers.

Research question 1. Research question one asks, if the data used to determine baseline and excellence levels for the North Carolina community colleges performance measures normally distributed. The results indicate that three of the performance measures (transfer

performance, licensure pass rate, and first year progression) do not come from a normal distribution. This can make it harder for colleges to effectively raise their performance level.

Research question 2. Research question two asks if there is a relationship between institutional characteristics and the performance of community colleges as measured by the North Carolina community college performance measures. The results indicate that the six of the performance measures (basic skills progress, credit English success, credit Math success, first year progression, curriculum completion, and licensure pass rate) show a statistically significant difference in performance levels based on at least one institutional characteristic.

Ultimately, this research shows the definition of the performance measures introduce bias into the evaluation of success in NC community colleges. Community colleges each serve a specific community which contributes specific characteristics to the institution. In trying to serve the students of their communities, each college is trying to meet the needs and expectations of a different population of individuals while trying to adhere to the same set of state-wide mandates.

Discussion

The results presented in this study suggest that the NC community college performance measures have inherent biases in their construction. These biases, in turn, contribute to the inability of some community colleges to meet state performance goals. Consider Bladen, Edgecombe, Halifax, James Sprunt, Martin, and Roanoke-Chowan community colleges. These six community colleges are classified as majority minority and are located in rural areas. Additionally, these colleges each have less than 3,000 students and serve counties in lowest economic tier. For these colleges, the four institutional characteristics (majority minority, modified degree of urbanization, college size, and county economic tier) all indicate the institutions will perform lower on six of the seven performance measures (first year progression,

licensure pass rate, basic skills progress, college Math success, college English success, and curriculum completion). From this list of colleges, Bladen, Edgecomb, Halifax, and Roanoke-Chowan all scored below average on at least four of the state performance measures. With the large number of institutional characteristics influencing lower performance scores for these colleges, it is evident there are few opportunities for these colleges to improve their performance. With little ability to improve under the existing performance measures, the question now becomes whether the current performance measure system is truly measuring community college success or if it serves as a mirror for equity issues based on race or poverty.

With this information, exploring alternative methods of assessing community college performance in the state of NC is a necessary step to ensure that students have access to quality information about community college performance, legislators have accurate information to inform accountability decisions, and educators have information that can help lead to improvement.

The NC community college performance measures are designed to be updated and modified over time (NCCCS, 2019a). The results of this study provide the ideal opportunity to adjust the current measures. Primary focus could be made to address the issues surrounding the construction of the measures and how data is collected for each measure. Appendix A presents an exploration of the construction for each measure, including subsets of the student population not counted in the performance measures. In addition to the issues related to the collection of data, this research points to five areas of improvement, none of which are mutually exclusive.

Changing the conversation. The most immediate impact of this research is the ability to change the conversation regarding the NC Community College Performance Measures. Currently, state legislation requires performance measures. These measures are then developed

by the North Carolina Community College System Office at the direction of the NC State Board of Community Colleges. The NC State Board also has final approval of the performance measures. With the information contained within this research, more informed conversations at the college level, between colleges and the system office, and with the NC State Board can occur. With more informed and relevant conversations comes the possibility of more equitable performance measures which will empower community colleges to improve student success in a way meaningful for students.

   Benchmark levels. The first approach to adjusting the current NC community college performance measures would be to re-examine the creation of baseline and excellence levels across the state. The current methodology uses properties of a normal distribution, namely the empirical rule, to identify the baseline as two standard deviations below the mean and excellence as one standard deviation above the mean. However, three of the performance measures (licensure pass rate, transfer performance, and first year progression) do not come from data that are normally distributed, and six of the measures (basic skills progression, curriculum completion, college English success, college Math success, transfer performance, and first year progression) come from data that are binomially distributed. This means that using standard deviation to determine baseline and excellence levels is not appropriate and could negatively impact colleges, especially those close to the cutoff score between performance levels. From the 2019 data, Davidson, Randolph, Sampson, and Western Piedmont Community Colleges were noted as above average (NCCCS, 2019a). However if the average was computed using a more appropriate binomial distribution, these four colleges would have been below average.

   Choosing fixed benchmark levels that were based on State Board expectations and research would eliminate two of the issues surrounding the current process. By setting a specific

goal without consideration for current community college performance, the system would no longer be pitting colleges against each other. This method would further allow for colleges to strive for a specific goal without fear that the benchmark would change in the next year. The final benefit to such a system of benchmark determination is that levels can be chosen based levels that seem appropriate. This is a marked change from the current system of benchmark determination which allows for colleges to be identified as excellent when half of their students do not succeed in a measure. This occurred in the 2019 performance measures, which noted Alamance, Cape Fear, Catawba Valley, Nash, Southwestern, and Stanly Community Colleges along with Caldwell Community College and Technical Institute as meet the state level of excellence in credit Math success even though less than 50% of their students were successful in credit Math courses (NCCCS, 2019a).

The Aspen Institute currently evaluates community college performance and looks to identify excellent community colleges (*The 2019 Aspen Price for Community College Excellence*, 2019). Instead of comparing all community college to each other, each community college is placed within a comparison group. This ensures that community colleges with differing institutional characteristics are not compared to each other for the determination of excellence. Only those colleges with similar characteristics are compared and each college is examined for their specific improvements in each of the performance metrics. Such a system could also be implemented within the current system of benchmarks to remove the competitive nature of comparing the large, urban, and predominantly white institutions (e.g. Wake Technical Community College) to the small, rural, and majority-minority institutions (e.g. Roanoke-Chowan Community College).

Principal-Agent theory. One approach to improving the current NC community college performance measures is to re-examine the performance measures through the lens of principal-agent theory. Principal-agent theory describes the relationship between two parties: the principal and the agent. The theory concludes that when the principal chooses an agent to act on the principal's interests, the principal may then have difficulty controlling the agent as the agent may act on independent goals and information (Kivistö, 2008; Ross, 1973).

Within principal-agent theory, there are two generally accepted responses from principals to exercise control of agents (Eisenhardt, 1989; Kivistö, 2008): behavior-based or outcome-based. The NC community college performance measures are an outcome-based control under which the agent receives a reward for achieving specific outcomes. This is seen with the performance funding model used in NC, in which community colleges are rewarded with additional funding based on the performance on each of the measures. Unfortunately, outcome-based controls are subject to opportunistic manipulation by the agent (Kivistö, 2008), which has been documented in the literature (Cullen & Reback, 2006; Figlio, 2006; Figlio & Winicki, 2005; Neal, 2013). Additional concerns arise when the lowest performing institutions are awarded the least amount of funding per student, as was the case in 2019 when Roanoke-Chowan was awarded approximately $13.84 per basic skills student and the nine colleges denoted as excellent were awarded approximately $177.40 per student (NCCCS, 2019a). What about the performance data implies that the lowest performing schools need less money in order to improve?

The alternative presented by principal-agent theory comes in the form of behavior-based rewards. The State Board of Community Colleges can still exercise a level of control over community colleges by selecting performance areas and allowing community colleges to

describe what specific behaviors will be used to improve the college's performance in a given area. Rewards can still be issued in the form of additional funding for behaviors deemed most likely to impact a given performance measure. This type of model is already used by philanthropic organizations attempting to improve education (e.g., Achieving the Dream, Bill and Melinda Gates Foundation). As an added level of support for such a model, the State Board is in the position to help enact statewide implementation of successful initiatives. This is seen through their coordination of past state-wide curriculum improvement projects and recent developmental education reform efforts.

The behavior-based approach is also seen on the national level with Aspen award winning community colleges. Joshua Wyner (2014) highlighted seven community colleges across the nation which were awarded the Aspen Prize for Community College Excellence. The colleges featured urban, rural, small, and extremely large institutions. Some of the featured colleges (Miami-Dade College, Valencia College) are majority minority institutions. Each institution featured a unique approach to addressing the needs of their specific community.

One such example is seen in Miami-Dade Community College and their work on meta-majors. This specific behavior has been shown to improve completion rates (Jenkins, Lahar, Fink, Ganga, Kopko, Brown, & Patterson, 2018; Waugh, 2016). The importance of meta-majors, or guided pathways is also seen in work from Completion by Design and Achieving the Dream. The NC State Board of Community Colleges could choose to reinforce the positive behavior of establishing and using meta-majors as a way of improving curriculum completion and transfer success.

Mission acknowledged performance summary. The current NC community college performance measures are a one-size-fits-all collection of metrics chosen by the State Board of

Community Colleges. The research presented in this paper uses readily-available data to identify structural biases in the current measures. These measures do not recognize the individual missions and communities of each of the 58 NC community colleges. The development of a new system of measures which both provide a performance summary and acknowledge the priorities of the community college mission is necessary.

One example of a mission acknowledged performance summary can be seen in the Complete College Tennessee Act (CCTA). The CCTA was an attempt to raise the postsecondary degree production in the state of Tennessee (Nwosu & Koller, 2014). While the metrics used for this act also serve as a one-size-fits-all measure of college performance, additional components provide for adjustments based on institutional characteristics. CCTA measures the number of credit hours completed (24, 48, and 72 – expected credits earned after 1, 2, and 4 years respectively); the number of degrees produced; research expenditures; transfer performance; and the six-year graduation rate. Notable within this performance measure, the state provides for additional weight to students from specific demographics. Namely, adult students (over the age of 25) and low-income undergraduates (Complete College Tennessee Act of 2010, 2010) that fall into any metric are worth 20% more toward the overall college performance. Additionally, the CCTA allows for each of the metrics used to be weighted based on institutional characteristics.

The history of NC community college performance measures includes a period where community colleges could choose one measure for additional incentive funding (North Carolina General Statute § 115D-31.3). A similar system in which community colleges can choose which metrics align best with the college mission would allow the State Board to continue to set performance goals. As an example using the current performance measures, a large urban institution with multiple transfer opportunities (e.g. Wake Tech and Central Piedmont

Community Colleges) may choose to focus on curriculum completion and transfer performance. Whereas a smaller rural college may choose to focus on basic skills progress and licensure pass rate. Majority minority institutions may then choose to focus on minority performance in credit English and Math courses. Each college is still working to advance performance goals set by the State Board, but is doing so in a way that best serves their community.

Care must still be taken with such a model, as it is still subject to manipulation by colleges. Steps must be taken to ensure that colleges are selecting performance measures that align with their mission and not selecting only the measures in which they have high performance.

Value added models. Value added models of assessment provide an additional alternative to the current assessment system used for NC community colleges. While the research surrounding value added models is highly critical (Clotfelter, Ladd, Vigdor, & Diaz, 2004; Kohn, 2001; Ladd, 2001), such models offer the benefit of removing the competitive nature inherent in the current model. Instead of comparing a community college to the performance of other institutions across the state, a community college would focus on that actual impact the college has on student performance. This benefit is important as more traditional models of assessment rely on standardized benchmarks which are largely impacted by student socioeconomic status (Clotfelter & Ladd, 1996). The impact of socioeconomic status is seen in the results of this research in the impact of county economic tier, and the college's Pell student category (low, medium, or high). Pell student category and county economic tier impact the credit English success, credit Math success, and licensure pass rate measures. This raises the question of whether these performance measures are evaluating student success in academic endeavors or the students' ability to overcome non-academic hardships.

The implementation of a value added model would take considerably more work than the current system. The current NC community college performance measures do not include baseline data on student performance from which to determine the value added by an institution. Tracking the same group of students across years is also a problem with a student population that is very fluid. The lack of reliable data system in the United States has been noted in the current research (Melguizo et al., 2017). Very few systems in the United States track student progress from K-12 institutions into higher education. With the prevalence of transfer between community colleges within North Carolina, tracking student performance from one institution to another also poses difficulties, as does identifying the source of any value added to the student. Strong models with a K-20 system of data do exist, such as the one found Texas (Cunha & Miller, 2014). The Texas system tracks all K-12 students to any Texas institution and links academic records to student higher education records in Texas. This allows research to better understand student demographics and prior learning opportunities. With this level of information, students can be grouped based on high school performance (e.g. took math in their senior year or had no math in their final year). Using a comprehensive data system has the further benefit of removing standardized tests, a key criticism of public education value added models.

While difficult to implement, a value added model has the potential to identify other concerns in student performance that are not clearly seen in the current data. One such case is the performance of Piedmont Community College, which scored below the system Excellence level in the credit English success measure (NCCCS, 2019a). However, a deeper look at the data shows that Piedmont Community College increased the proportion of African American students succeeding in college level English from 43% to 67% (NCCCS, 2019a) in the most recent

performance measures. Only three other community colleges (Brunswick, Halifax, and Isothermal Community Colleges) had an increase in African American performance this large. African American students outperformed White students (66% successful) for the first time since this measure began being tracked (NCCCS, 2019a). Brunswick Community College is the only other institution where African American students were more successful than White students. The current set of performance measures provides no acknowledgement of this outcome, which is of significant value given that the majority of community colleges in NC have African American students underperforming White students in the credit English success measure (NCCCS, 2019a). Value added models provide the opportunity to recognize such accomplishments and differences between institutions without having institutions compete with each other (Cunha & Miller, 2014; Hoxby, 2015)

Labor market outcomes. There are no measures seen in the NC community college performance measures that are related to labor market outcomes. This is concerning when viewed through the work of Deming and Figlio (2016) who noted, "However, the variables that are included and excluded send signals to the general public about what is valued and what is not, which in turn raises underlying questions: What are the desired outcomes of postsecondary education?" (p. 44). This is also surprising given the more recent emphasis on success measures for community colleges to include labor market outcomes and employment opportunities in addition to more traditional student success measures, access, and completion.

If labor market outcomes are important to community colleges in NC as suggested by the mission statement for the State Board of Community Colleges, then why are they not assessed as part of community college performance? The NC community college performance measures provide measures on institutional level performance without providing any information on the

goals of students entering the community college, a trend also noted by Bailey and Xu (2012). Of the seven performance measures used for NC community colleges, licensure pass rate comes the closest to a labor market outcome. But this measure too falls short as it assumes the inherent value of the credential (Matsudaira, 2016). Gaining professional licensure does not guaranteed employment in the field nor does it guarantee an job that provides a living wage. Additionally, the licensure pass rate measure does not assess professional fields for which licensure is not required. For these fields (e.g. plumbing, welding, automotive) curriculum completion becomes the closest measure for student success.

However, students that obtain the necessary job skills in order to obtain employment may choose not to complete a degree. Under the current system, students who leave community college having gained the skills necessary for a job without obtaining a degree are not counted as successes in the performance measures. Many students focused on employability skills will not take Math or English courses as they do not provide quantifiable skills that lead to employment, nor would such students be driven to complete their first year or the entire curriculum if the skills gained early in the program open job opportunities not seen prior to enrollment. Yet the question remains, if the student reaches their goals, has the community college been successful?

Suggestions for Future Research

The research presented in this paper is far from complete. This paper focused on data that was readily available. The decision about which data to use was made in order to allow results that could be easily used to adjust the current performance measure process. Data not readily available could provide additional information on inherent biases or shed light on the effect of correlations noted in this research. A few of such variables could be average age at the

institution, average family education level, proportion of students identified as first-generation college, and average student income.

In addition to exploring new institutional characteristics, further research is needed to better understand the interactions between institutional characteristics found to have an impact on college performance measures. For example, are the findings of rural area colleges' impact on first year progression and college size impact on first year progress different findings, or are they measuring the same impact using different variables?

Consideration of variables not found to be significant at the $p < 0.05$ level also warrants further consideration. The variables presented in Table 5.3 are those significant at the $0.05 < p < 0.1$ level.

Table 5.3

Variables with significance at the 0.05 < p < 0.1 level

Performance Measure	Institutional Characteristic
Basic skills progress	Number of students Proportion of students receiving Pell grants
Credit English success	Modified degree of urbanization Proportion of students classified as full-time, first-time
Credit Math success	Proportion of students receiving Pell grants
First year progression	Proportion of students classified as continuing
Curriculum completion	Proportion of students classified as full-time, first-time Proportion of students classified as continuing Proportion of instructional staff classified as part-time
Transfer performance	Proportion of students receiving Pell grants Proportion of students classified as full-time Proportion of students classified as transfer Proportion of students classified as continuing County economic tier
Licensure pass rate	_[a]

a: Licensure pass rate has no significance at the $0.05 < p < 0.1$ level

These variables warrant further research to further investigate their impact on institutional characteristics. Furthering this research is of more importance in areas where the institutional characteristics are shown to have an impact on student success. This includes transfer performance and county economic tier (Ireland, 2015), and curriculum completion with proportion of faculty classified as part-time (Clotfelter, et al., 2013).

In addition to adding to the research presented here, other areas of research could provide additional insight into the use of performance measures in the state of NC. As noted in the discussion above, no current performance measure includes labor market outcomes. Research into the labor market impact of community colleges could contribute to a better understanding of what makes a community college a success. Similarly, all data examined in this study focused on institutional characteristics and the impact to the college population. Additional research into how institutional characteristics impact subsets of an institutional population would provide valuable information in the creation of new performance measures.

Additionally, the research presented in this paper identified concerns and biases with the current NC community college performance measures. Research into developing a specific model that would address the needs of legislature, the State Board of Community Colleges, and the individual community colleges is warranted. The model developed should also use this research to minimize the impact of bias on the performance measures selected.

Finally, the research contained within this paper focuses entirely on the NC. The results, while significant in many cases, do not necessarily apply to community colleges outside of the state of NC. Research similar in scope to this study, but using data from other states, would broaden the collective knowledge of institutional characteristics and community college performance.

Conclusion

This research presents a brief history of performance measurement in the NCCCS as well as an examination of existing policies and practices for evaluating public community colleges in North Carolina. Using a principal-agent framework, current literature surrounding college and student performance was evaluated to identify potential institutional characteristics that may impact community college performance on the NC community college performance measures.

Statistical analyses were completed using Kruskal-Wallis, Mann-Whitney U, and Kendall's τ_b tests to determine if the existing performance measures followed a normal distribution and to identify correlation with institutional characteristics identified in readily available data. These tests showed a statistically significant (minimum $p < 0.05$) impact on community college success measures from 10 institutional characteristics, implying that the existing basic skills progress, credit English success, credit Math success, first year progression, curriculum completion, and licensure pass rate measures are biased toward colleges with certain institutional characteristics. Additional testing of kurtosis and skewness along with a Shapiro-Wilk test show that the performance measure data for the transfer performance, licensure pass rate, and first year progression performance measures do not come from a normal distribution. These findings call into question the use of a normal distribution to determine baseline and excellence levels for NC community colleges.

Ultimately, this research brings to mind the saying, "Remember that all models are wrong; the practical question is how wrong do they have to be to not be useful." (Box and Draper, 1997). This research shows that the current NC community college performance measures have inherent biases in their construction. While no performance assessment model will be perfect, addressing the biases identified using readily-available institutional

characteristics will provide the opportunity for performance measures that better represent the

community college and provide a more accurate picture of the institution's effectiveness within

their own community.

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APPENDICES

Appendix A: Current North Carolina Community College Performance Measures

Basic skills student progress. This measure looks at the number of participants in basic skills programs over one program year (July 1 to June 30). The performance measure counts participants that leave a basic skills program and return after more than 90 days as two participants. This means that a student that begins in August and leaves the basic skills program in October to return in February counts as two students. Whereas a student that remains enrolled throughout the same time will counts as a single student. This creates an issue when the number of students impacted by a measure are used in the calculation of performance funding.

Students are successful in this measure if the student demonstrates a measurable skills gain (NCCCS, 2019a). In 2019, the excellence level was set at 50.6% and the baseline level was set at 24.2%. The system average, based on data from the 2017 – 2018 year, was 39.9%. These attainment levels are extremely low as indicators of quality and represent the difficulties that occur when establishing baselines based on standard deviations.

Despite these low bars, for the 2017 – 2018 year, the basic skills progress measure identified 9 schools as meeting the excellence level designation. Each of the 9 schools was successful with between 51% and 59.3% of their basic skills students. At the other end of the spectrum, there is a single college with a 13.4% success rate in basic skills performance. In both cases, a significant portion of basic skills students are not receiving the help needed to achieve academic success.

Student success rate in college-level English courses. This measure counts the proportion of first-time fall associate degree and transfer pathway students who earn a passing grade in a curriculum-level English course within nine semesters (NCCCS, 2019a). In the NC curriculum-level courses are non-developmental courses numbered 100 or higher. The nine

semesters represent three years, or 150% of the expected completion time. This means students who take three years to pass a curriculum-level English course are considered as successful completers on this measure. The NC community college performance measures consider students starting in the summer semester as first-time fall students for purposes of this measure, allowing summer start students ten semesters to earn a passing grade in a curriculum-level English course. In 2019, the excellence level was set at 66.6% (as determined by one standard deviation above the mean) and the baseline level was set at 40.1% (as determined by two standard deviations below the mean). The system average, based on the Fall 2015 cohort, was 61.7%.

This measure does have higher excellence and baseline levels, compared to the Basic Skills student progress measure but has other concerns in the selection of the students counted. The measure only counts first-time (both full- and part-time) fall students as part of the measured cohort of students. As discussed previously, this definition excludes a wide range of students including all transfer students. Any student beginning their higher education career at another institution and then transferring to a community college are not counted in the community college's performance measures, even if successful in English and Math. In the Fall 2017 semester, the NCCCS had 16,765 transfer students (IPEDS, 2017). Transfer students account for approximately 33% of students beginning at a community college in the Fall 2017 semester.

Career and College Promise (CCP) students are another category of students not fully represented by this measure. The state performance measures classify current high school students taking college courses for credit as first-time students (NCCCS, 2019a, p. 19). Students in CCP must take courses that apply to a system-approved pathway. College transfer pathways include English and Math courses as an option, but the courses are not required. Within the career and technical education pathways English and Math courses may not be an option

(NCCCS, 2019b). For the CCP students, this creates a group that is measured on English and Math completion but for whom English or Math may not be a required course. In the 2017-2018 academic year, there were 36,491 CCP students (NCCCS, 2019e) enrolled in a NC community college. This represents approximately 20.9% of students enrolled during the academic year which will not be counted in multiple success measures.

An additional concern found in the construction of the success in college-level English courses measure is how the measure counts students that do not attempt English. This includes students who begin community college with Advanced Placement (AP) credit for English. The AP students may not take additional English courses while at a community college. The success rate in college-level English courses measure counts students who do not attempt English as unsuccessful. With this definition, the measure penalizes colleges with a large number of AP students.

A final challenge with this measure is that it does not inform the college on what resources are needed to improve success. From the data, the college cannot know if low performance on this measure is a result of students not taking English, or from students taking English and not passing.

Student success rate in college-level Math courses. This measure counts the proportion of first-time fall associate degree and transfer pathway students who earn a passing grade in a curriculum level Math course within nine semesters (NCCCS, 2019a). In the NCCCS, curriculum-level courses are non-developmental courses numbered 100 or higher. As with the student success rate in college-level English courses measure, the nine semesters represent three years, or 150% of the expected completion time. This means students who take three years to pass a curriculum-level Math course are considered as successful completers on this measure.

The NC community college performance measures consider students starting in the summer semester as first-time fall students for purposes of this measure, allowing summer start students ten semesters to earn a passing grade in a curriculum-level Math course. In 2019, the excellence level was set at 46.2% and the baseline level was set at 19.5%, based on one standard deviation above and two standard deviations below the mean respectively. The system average, for Fall 2015 cohort was 41.5%.

Student success rates in college-level Math courses suffer from the same concerns as the performance measure tied to college-level English courses and those of the Basic Skills progression measure. With an excellence level set below 50%, future success in mathematics courses and a label of excellence for this level of accomplishment are called into question. With the state-wide implementation of new placement policies, students with a 2.6 high school GPA will be able to self-select the Math courses they take upon entry to a community college. This allows students to choose from career and technical math courses such as MAT-110 (Math Measurement & Literacy) or MAT-121 (Algebra/Trigonometry I), quantitative literacy courses such as MAT-143 (Quantitative Literacy) and MAT-152 (Statistical Methods I), or MAT-171 (Precalculus Algebra) which is a Calculus preparation course. The full impact of this policy allowing for students to place themselves into courses through self-selection has not been studied in NC.

As discussed with the English success measure, CCP students again present an issue with the selection of measured students. Students in CCP must take courses that apply to a system approved pathway. College transfer pathways include English and Math courses as an option, but the courses are not required. Within the career and technical education pathways English and Math courses may not be an option (NCCCS, 2019b). For the CCP students, this creates a group

that is measured on English and Math completion but for whom English or Math may not be a required course. In the 2017-2018 academic year, there were 36,491 CCP students (NCCCS, 2019e) enrolled in a NC community college. This represents approximately 20.9% of students enrolled during the academic year which will not be counted in multiple success measures.

An additional concern found in the construction of the success in college-level Math courses measure is how the measure counts students that do not attempt Math. This includes students who begin community college with Advanced Placement (AP) credit for Math. The AP students may not take additional Math courses while at a community college. The success rate in college-level Math courses measure counts students who do not attempt Math as unsuccessful. With this definition, the measure penalizes colleges with a large number of AP students. Additionally, the measure does not inform the college on what resources are needed to improve success. From the data, the college cannot know if low performance is a result of students not taking Math, or from students taking Math and not passing.

First year progression. This measure counts the proportion of first-time fall credential seeking students who either graduate prior to the subsequent fall term or enroll in post-secondary education during the subsequent fall term (NCCCS, 2019a). The National Student Clearinghouse provides additional graduation and enrollment data to inform this measure. In 2019, the excellence level was set at 71.9% and the baseline level was set at 56.6%. The system average, based on the Fall 2017 cohort, was 67.2%.

This performance measure excludes all transfer students to a college. Based on data from the Integrated Postsecondary Education Data System, there are 33,838 first-time students attending a NC community college in the Fall of 2018 (IPEDS, 2018). There were an additional 16,765 students that transferred into a NC community college in the Fall of 2018. These totals

represent 50,603 students that began at a NC community college, new to the student, in the Fall of 2018. However, the first year progression measure does not count 33% of the new to the college students because they have prior college experience. Even though the State Board of Community Colleges created the NC Combined Course Library in such a way as to ease transfer between community colleges, as soon as a student moves from one community college to another, the student is no longer considered in this performance measure.

Curriculum Completion. This measure identifies the proportion of first-time fall credential seeking students who have graduated, transferred to a 4-year institution, or are still enrolled with at least 42 curriculum credits after 12 semesters (NCCCS, 2019a). The 12 semesters used represents 4 years, or 200% of the standard completion time. The NC community college performance measures consider students starting in the summer semester as first-time fall students for purposes of this measure, allowing summer start students 13 semesters to meet the completion requirements. In 2019, the excellence level was set at 52.7% and the baseline level was set at 34.1%. The system average, based on the Fall 2014 cohort, was 47.6%.

Curriculum completion is another measure where the excellence levels are set at targets that do not appear to align with expectations. While no college will achieve a 100% completion rate, setting an excellence level at 52.7% gives the appearance of accepting that around half of your students will not succeed.

The curriculum completion measure provides students 12 semesters, or 4 years, to complete their curriculum. This is 200% of the standard time for an associate degree. However, students counted in the measure include students working towards a certificate or diploma which typically have a time to completion much shorter than an associate degree. This definition allows for easy manipulation of metrics using certificates earned while working toward a degree. From

a mathematical perspective, the inclusion of students still enrolled with at least 42 credits toward their degree also raises questions. Students with 42 credits toward their degree have completed roughly 70% of their degree and have taken twice as long as intended to reach this milestone. This raises the question, are the student counted by this portion of the measure successful?

College transfer performance. This measure identifies students who earned an Associate degree or at least 30 transfer credits and were subsequently enrolled at a 4-year institution in the fall semester. Of these students, the college transfer performance measure is the proportion of students who either graduated from or remained enrolled in a 4-year institution in the subsequent fall semester (NCCCS, 2019a). In 2019, the excellence level was set at 89.4% and the baseline level was set at 74.4%. The system average, based on students enrolling at a 4-year institution in the Fall of 2016, was 85.9%.

Licensure and certification pass rate. This measure represents a weighted index score of first-time test takers pass rates on state mandated licensure and certification exams. The performance measure categorizes and weights each exam into tiers (NCCCS, 2019a). Tiers match the tier classification of the courses required prior to taking the licensure or certification exam. In 2019, the excellence level was set at 1.07 and the baseline level was set at 0.79. The system average based on students taking exams in the 2017 – 2018 academic year was 1.00.

The calculations for this measure compute a weighted average. The measure assigns each program a tier (see Appendix O for a list of program tiers). Tier 2 and 3 programs use a weighted multiplier of 1.00. Tier 1B has a weighted multiplier of 1.15 and tier 1A uses a multiplier of 1.30. This creates a system where licensure or certification tests are not weighted equally. This can create an advantage for colleges with a large number of tier 1A programs and a disadvantage for colleges with a large number of Tier 2 or 3 programs. The value is further varied by the

success rate of the college. For colleges with a success rate much higher than the average state pass rate, each successful student contributes more to the college's weighted index. This is the only performance measure with such a mechanism, allowing for students within the same college to contribute to the college's performance measure differently. This system values the completion of some professional licenses and certificates (e.g. Nursing, Radiography) over other professions (e.g. Fire Inspector, EMT).

The NCCCS first used this measure in the 2019 performance measures, and it is the only measure not presented as a percentage of successful students. This creates an immediate disconnect with the measure as the value has no inherent meaning to the college. Knowing that a college has a specific score provides no information about the performance of the college. This is a property unique to the licensure and certification passing rate measure. The value each college has for this performance measure is only of use as a tool for comparison.

Appendix B: North Carolina Community College Performance Measures

(NCCCS, 2019a)

Community College	Basic Skills Progress	Credit English Success	Credit Math Success	First Year Progression	Curriculum Completion Rate	Transfer Performance	Licensure Pass Rate Index
System Excellence Level	50.6%	66.6%	46.2%	71.9%	52.7%	89.4%	1.07
System Baseline	24.2%	40.1%	19.5%	56.6%	34.1%	74.4%	0.79
Average College Percentage	41.8%	61.0%	41.5%	68.2%	49.3%	85.2%	0.98
System Totals (All Students)	39.9%	61.7%	41.5%	67.2%	47.6%	85.9%	1.00
Alamance CC	40.5%	67.3%	46.6%	59.4%	41.6%	83.9%	0.98
Asheville-Buncombe TCC	36.1%	52.9%	39.8%	54.6%	46.8%	86.0%	1.01
Beaufort County CC	39.2%	57.0%	50.2%	70.9%	48.6%	86.1%	0.93
Bladen CC	30.3%	57.4%	35.5%	68.8%	50.8%	88.3%	0.88
Blue Ridge CC	40.3%	54.1%	33.3%	61.6%	47.2%	90.8%	0.97
Brunswick CC	47.3%	73.1%	58.8%	77.4%	52.8%	91.3%	0.94
Caldwell CC & TI	35.0%	56.2%	47.4%	65.3%	49.5%	83.8%	1.03
Cape Fear CC	40.0%	66.6%	47.3%	69.1%	47.8%	84.9%	1.13
Carteret CC	36.2%	61.3%	39.9%	70.5%	50.8%	80.6%	1.06
Catawba Valley CC	45.6%	70.4%	47.2%	70.4%	53.3%	84.3%	1.06
Central Carolina CC	45.3%	48.9%	43.6%	67.7%	54.3%	86.0%	1.00

Table B1 (Continued.)

Community College	Basic Skills Progress	Credit English Success	Credit Math Success	First Year Progression	Curriculum Completion Rate	Transfer Performance	Licensure Pass Rate Index
Central Piedmont CC	33.8%	68.9%	46.7%	65.0%	44.8%	86.6%	1.09
Cleveland CC	57.0%	51.2%	45.5%	65.9%	52.5%	85.1%	1.00
Coastal Carolina CC	47.9%	72.7%	43.6%	64.4%	49.7%	84.3%	1.13
College of the Albemarle	31.2%	59.6%	37.3%	70.4%	53.3%	90.4%	1.01
Craven CC	43.4%	69.1%	40.5%	66.6%	48.0%	85.9%	0.89
Davidson County CC	58.8%	67.2%	53.1%	71.1%	49.8%	85.8%	1.08
Durham TCC	35.6%	59.0%	40.2%	64.6%	45.9%	88.5%	1.03
Edgecombe CC	49.9%	64.8%	31.5%	70.6%	43.4%	84.4%	0.84
Fayetteville TCC	37.6%	47.4%	26.3%	63.5%	39.4%	81.9%	0.92
Forsyth TCC	28.9%	67.9%	40.0%	67.3%	43.4%	84.3%	1.10
Gaston College	38.3%	58.8%	35.0%	67.3%	44.8%	82.0%	1.03
Guilford TCC	24.7%	54.9%	31.6%	63.2%	41.5%	82.5%	0.95
Halifax CC	42.3%	67.0%	28.6%	64.7%	51.1%	84.5%	0.95
Haywood CC	49.8%	58.1%	33.6%	70.3%	53.2%	84.2%	0.96
Isothermal CC	31.3%	64.7%	34.9%	68.9%	54.2%	78.1%	0.93
James Sprunt CC	34.1%	66.0%	51.3%	77.0%	62.3%	76.3%	1.04
Johnston CC	52.7%	64.1%	51.8%	70.1%	55.1%	91.0%	1.09

Table B1 (Continued.)

Community College	Basic Skills Progress	Credit English Success	Credit Math Success	First Year Progression	Curriculum Completion Rate	Transfer Performance	Licensure Pass Rate Index
Lenoir CC	48.6%	67.9%	40.9%	67.7%	48.7%	84.8%	0.94
Martin CC	51.3%	50.8%	41.7%	76.4%	57.6%	90.9%	0.98
Mayland CC	52.5%	41.1%	35.0%	66.4%	43.9%	80.8%	1.03
McDowell TCC	44.1%	69.9%	55.1%	70.9%	52.4%	86.8%	1.02
Mitchell CC	38.1%	60.8%	35.3%	69.8%	55.8%	86.0%	1.04
Montgomery CC	40.5%	62.0%	29.1%	78.2%	54.2%	90.0%	0.97
Nash CC	47.1%	47.1%	47.9%	64.5%	37.7%	82.6%	0.98
Pamlico CC	58.7%	48.1%	51.9%	75.4%	58.2%	68.8%	0.58
Piedmont CC	43.0%	66.0%	44.2%	67.7%	50.5%	87.9%	1.05
Pitt CC	39.0%	57.2%	32.1%	65.2%	46.2%	88.1%	0.98
Randolph CC	42.3%	66.4%	43.5%	65.4%	50.3%	85.4%	0.98
Richmond CC	35.7%	65.1%	58.3%	72.6%	49.7%	79.5%	1.01
Roanoke-Chowan CC	13.4%	53.8%	27.4%	78.7%	47.5%	85.1%	0.93
Robeson CC	43.1%	49.8%	42.9%	52.9%	40.0%	81.8%	0.82
Rockingham CC	51.1%	61.6%	38.2%	67.9%	46.1%	87.9%	0.88
Rowan-Cabarrus CC	46.9%	63.7%	34.0%	69.0%	43.6%	83.5%	0.93
Sampson CC	59.3%	56.6%	35.6%	74.3%	52.1%	85.2%	0.82

Table B1 (Continued.)

Community College	Basic Skills Progress	Credit English Success	Credit Math Success	First Year Progression	Curriculum Completion Rate	Transfer Performance	Licensure Pass Rate Index
Sandhills CC	38.3%	64.6%	37.5%	72.2%	50.1%	88.8%	0.99
South Piedmont CC	45.1%	55.2%	39.4%	69.8%	48.5%	88.0%	0.94
Southeastern CC	45.0%	57.3%	34.0%	67.8%	44.0%	86.0%	0.89
Southwestern CC	38.5%	70.6%	49.0%	63.6%	51.5%	87.4%	0.98
Stanly CC	31.2%	56.8%	47.7%	71.5%	56.8%	84.2%	0.97
Surry CC	43.6%	54.5%	32.9%	65.8%	50.4%	93.4%	1.13
Tri-County CC	49.4%	77.0%	34.3%	67.4%	52.7%	79.1%	0.82
Vance-Granville CC	39.6%	67.4%	31.8%	68.2%	48.3%	88.3%	0.90
Wake TCC	41.0%	60.0%	43.2%	70.8%	47.3%	90.1%	1.12
Wayne CC	48.7%	69.4%	47.9%	69.9%	54.7%	88.9%	1.00
Western Piedmont CC	35.7%	70.3%	51.4%	67.5%	47.2%	85.4%	1.12
Wilkes CC	52.5%	64.5%	53.7%	67.0%	49.4%	83.1%	0.93
Wilson CC	28.9%	55.5%	49.6%	67.3%	47.6%	80.2%	0.95

Appendix C: Detailed Definitions of Selected Dependent Variables

Carnegie Classification Award Type.

Colleges are categorized as either high transfer, high career and technical, or mixed transfer/career and technical (IPEDS, 2018). For institutions awarding the Associate degree as the highest credential, Carnegie (n.d.) defines these classifications based on the percentage of degrees and certificates awarded in career and technical programs. Institutions awarding fewer than 30% of awards in career and technical programs are classified as high transfer, those awarding more than 50% of awards in career and technical programs are classified as high career and technical, and those awarding 30% - 49% of degrees and certificates in career and technical programs are classified as mixed transfer/career and technical. Carnegie classification designations for the 58 community colleges was based on general information from the 2018/2019 academic year.

Carnegie Classification Student Type

This classification was also based on general information from the 2018/2019 academic year. Colleges are categorized as having a student type that is either high traditional, high nontraditional, or mixed traditional/non-traditional (IPEDS, 2018). This classification is determined by a student mix index which represents the proportion of degree seeking students at an institution multiplied by the proportion of students enrolled in the fall semester. Colleges with a student mix index lower than 0.47 are classified as high non-traditional and colleges with a student mix index higher than 0.58 are classified as high traditional. All other colleges are classified as mixed traditional/non-traditional.

Degree of Urbanization

A classification representing the urbanicity by population size. The code for each institution was assigned using a methodology developed by the U.S. Census Bureau's Population division (IPEDS, 2019). The potential values for this variable are:

- City: Large – Institution located inside an urbanized area and inside a principal city with population of 250,000 or more.

- City: Midsize – Institution located 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 – Institution inside an urbanized area and inside a principal city with population less than 100,000.

- Suburb: Large – Institution outside a principal city and inside an urbanized area with population of 250,000 or more.

- Suburb: Midsize – Institution outside a principal city and inside an urbanized area with population less than 250,000 and greater than or equal to 100,000.

- Suburb: Small – Institution outside a principal city and inside an urbanized area with population less than 100,000.

- Town: Fringe – Institution inside an urban cluster that is less than or equal to 10 miles from an urbanized area.

- Town: Distant – Institution inside an urban cluster that is more than 10 miles and less than or equal to 35 miles from an urbanized area.

- Town: Remote – Institution inside an urban cluster that is more than 35 miles from an urbanized area.

- Rural: Fringe – Institution located inside a census-defined rural area that is 5 or fewer miles from an urbanized area or 2.5 or fewer miles from an urban cluster.

- Rural: Distant – Institution located inside a census-defined rural area that is more than 5 miles but 25 or fewer miles from an urbanized area, or more than 2.5 miles but 10 or fewer miles from an urban cluster.

- Rural: Remote – Institution located inside a census-defined rural area that is more than 25 miles from an urbanized area or more than 10 miles from an urban cluster.

Proportion of Students Classified as First-Time

The proportion of students attending the institution which were classified as first-time in the Fall 2017 semester. Students are classified as first-time if they have no prior post-secondary enrollment or credits gained prior to graduation from high school (IPEDS, n.d.b).

Proportion of Students Classified as Full-Time

The proportion of students attending the institution which were classified as full-time in the Fall 2017 semester. Students are classified as full-time if they are enrolled for 12 or more semester credits. (IPEDS, n.d.b).

Proportion of Students Classified as Transfer

The proportion of students attending the institution which were classified as a transfer student in the Fall 2017 semester. Students which are known to have previously attended a postsecondary institution and are attending the institution for the first-time in the Fall 2017 are classified as transfer students (IPEDS, n.d.b).

Proportion of Students Classified as Non-Degree/Certificate Seeking

The proportion of students attending the institution which were classified as a non-degree/certificate seeking student in the Fall 2017 semester. Students which are not seeking a

degree, certificate, or other formal award are classified as non-degree/certificate seeking. This

value includes high school students which have not yet graduated. (IPEDS, n.d.b).

Appendix D: Scatterplots of Proportion of students reported as female vs. North Carolina

Community College Performance Measures
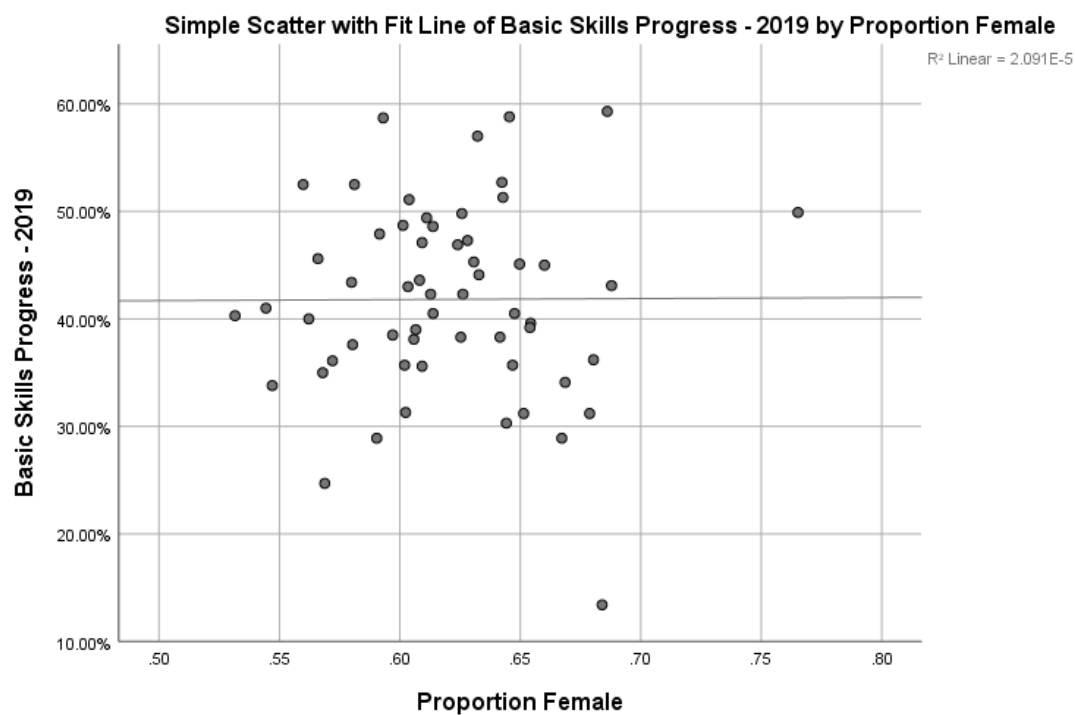
Figure D.1 Proportion of students reported as female vs. basic-skills progress performance measure
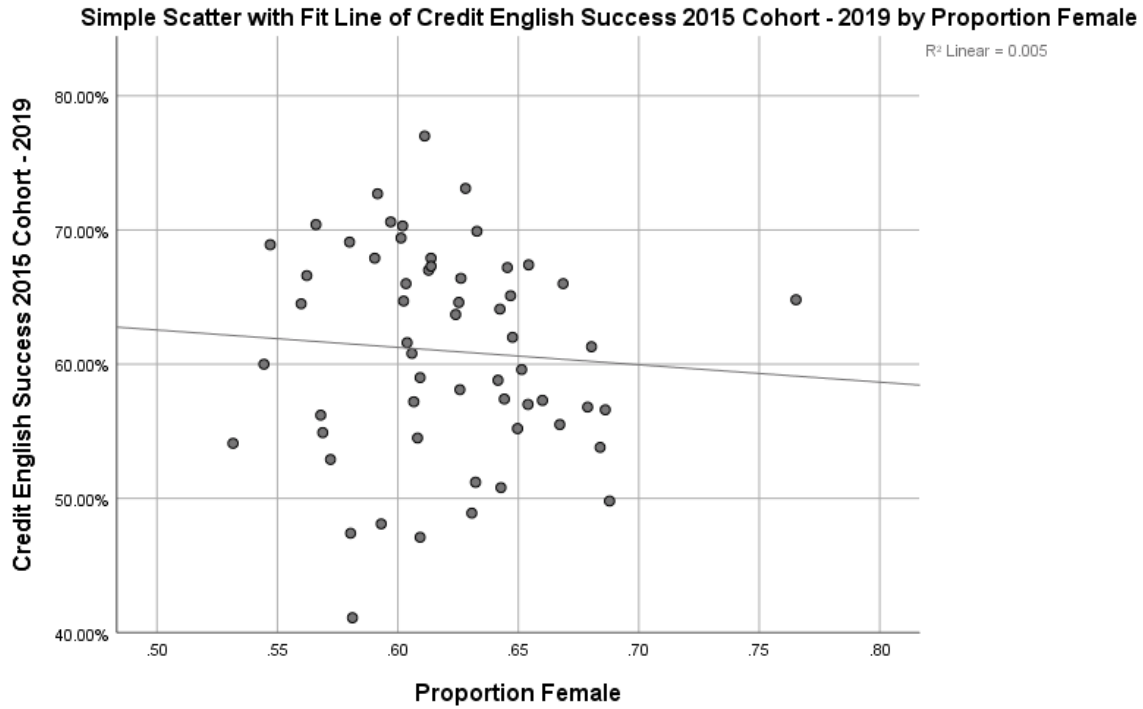
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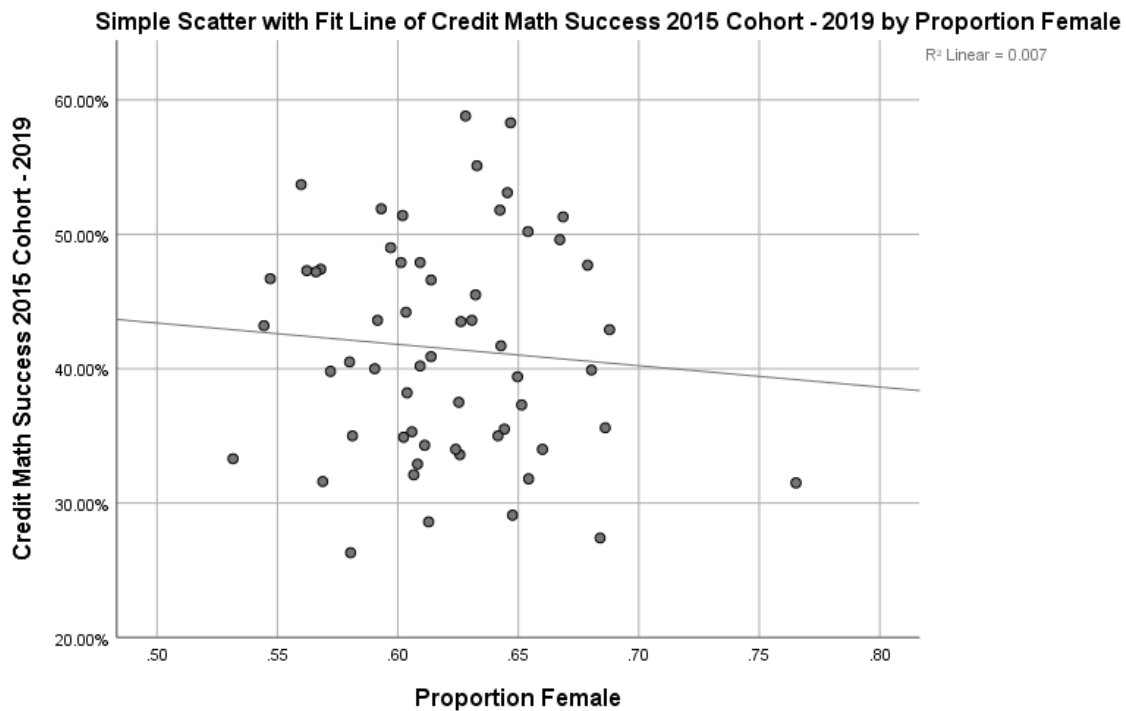
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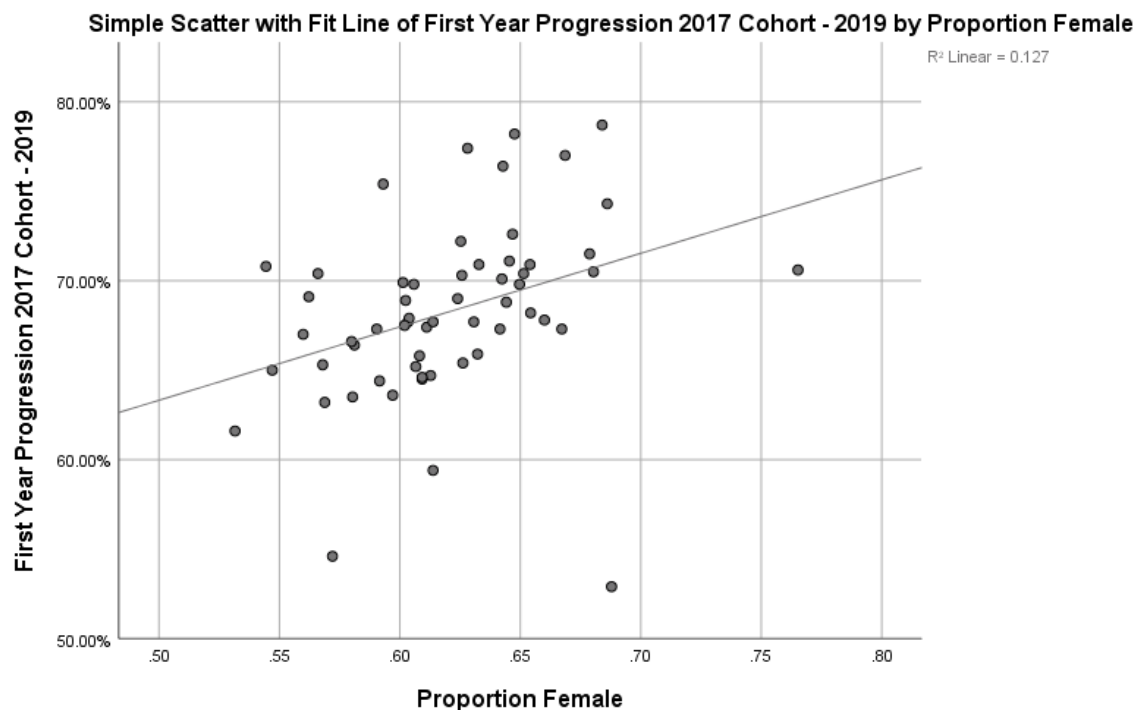
Figure D.4 Proportion of students reported as female vs. first year progression performance measure
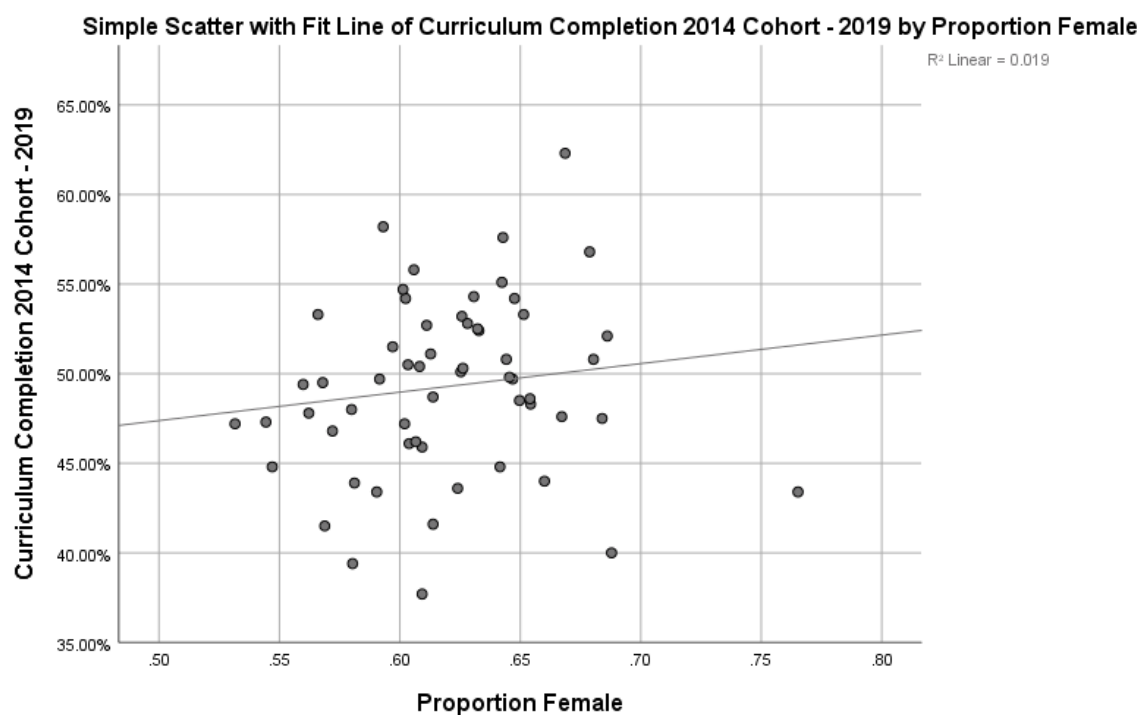
Figure D.5 Proportion of students reported as female vs. curriculum completion performance measure
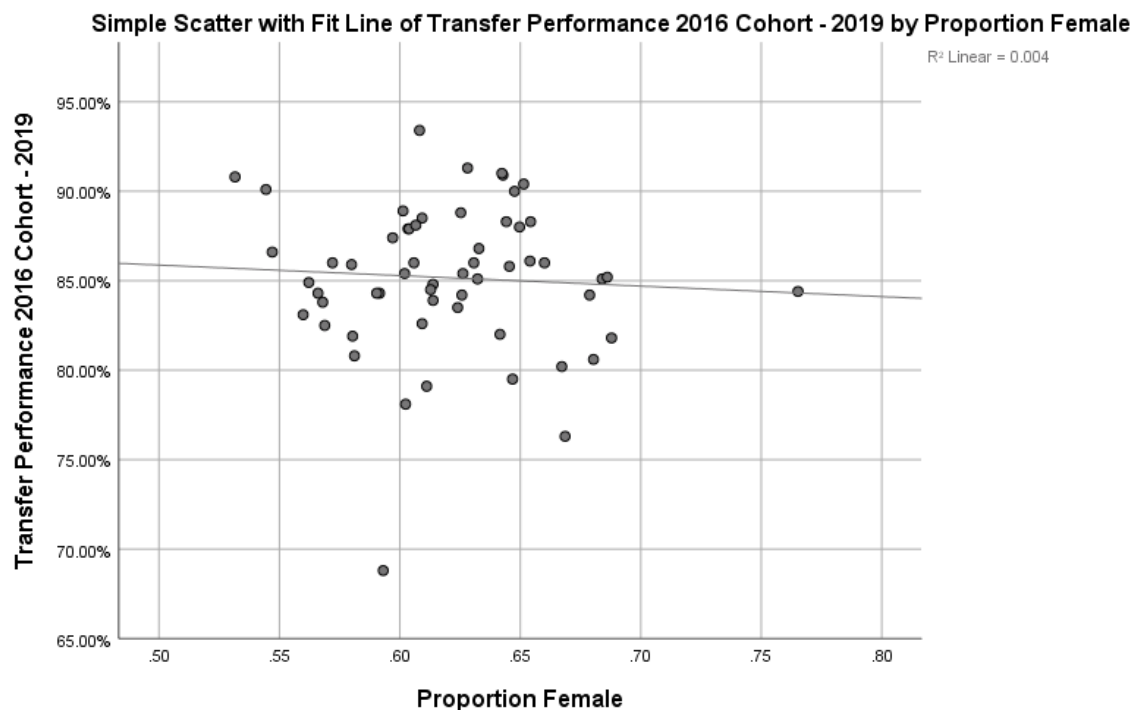
Figure D.6 Proportion of students reported as female vs. transfer performance success measure
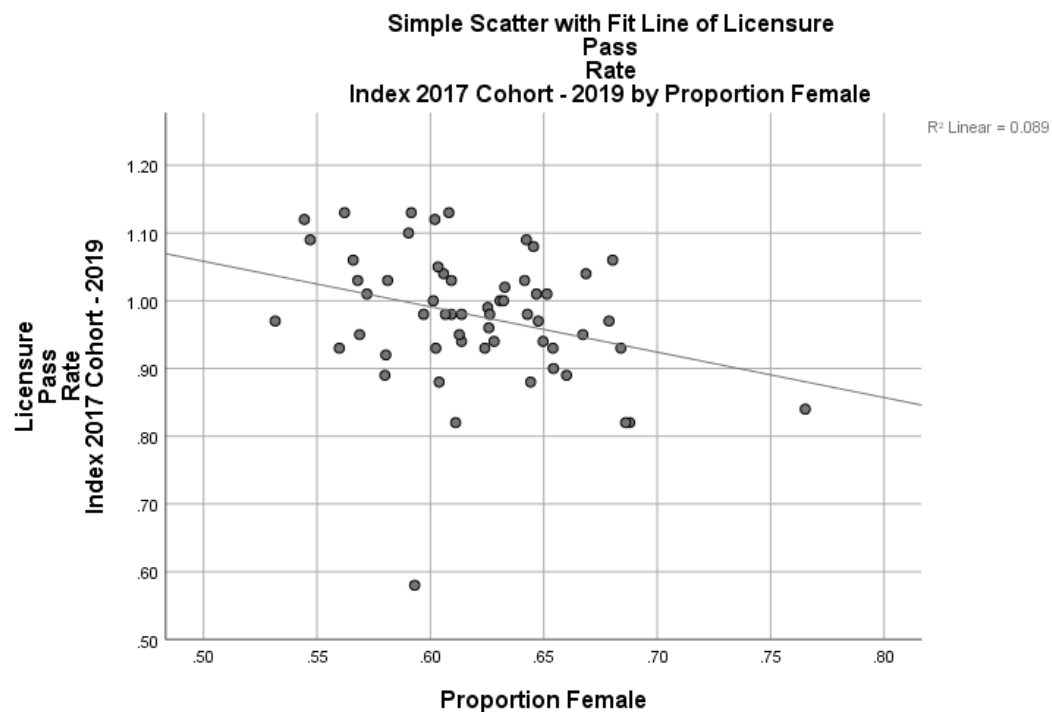
Figure D.7 Proportion of students reported as female vs. licensure pass rate performance measure

Appendix E: Scatterplots of Number of Students vs. North Carolina Community College

Performance Measures
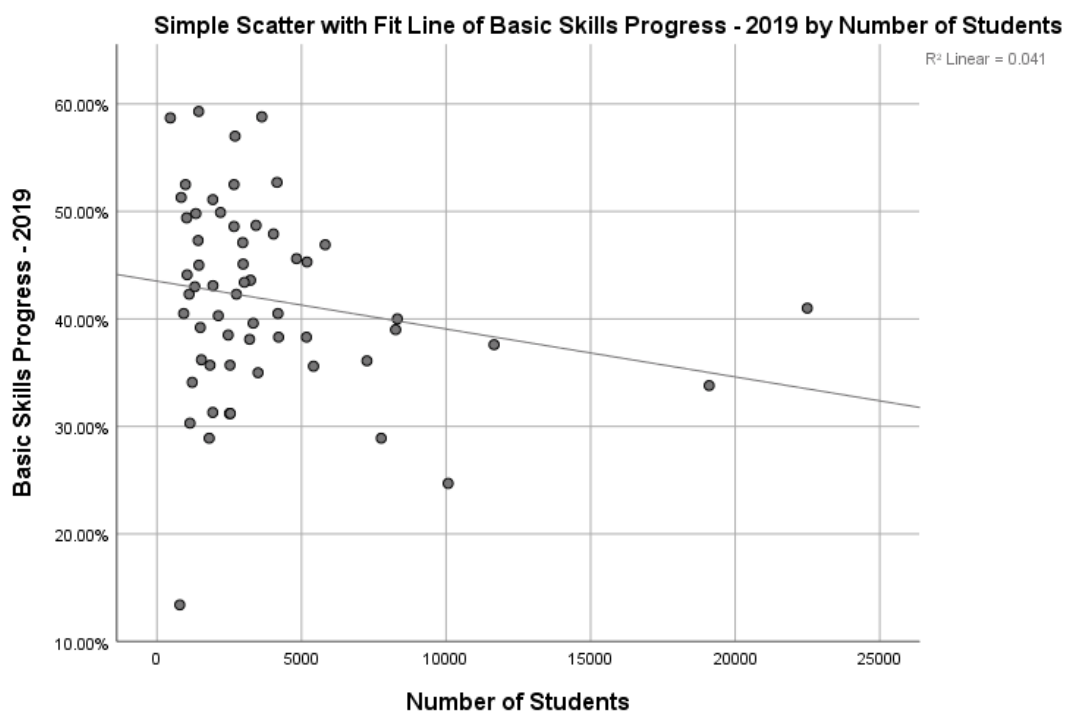
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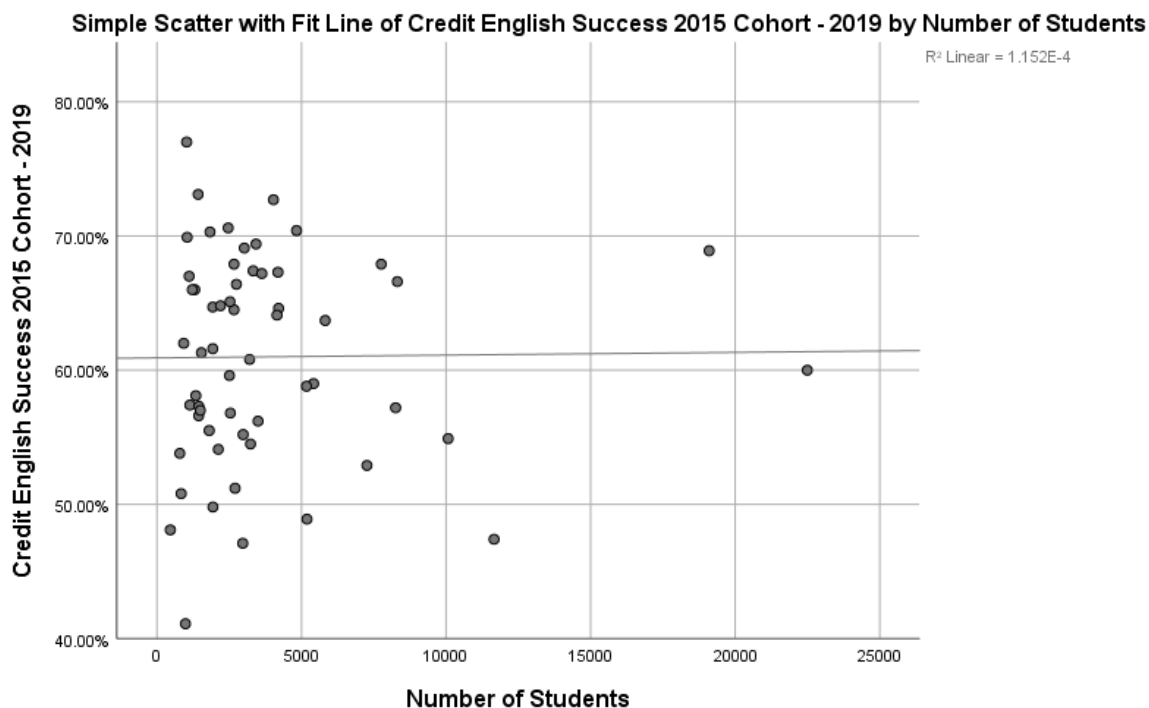
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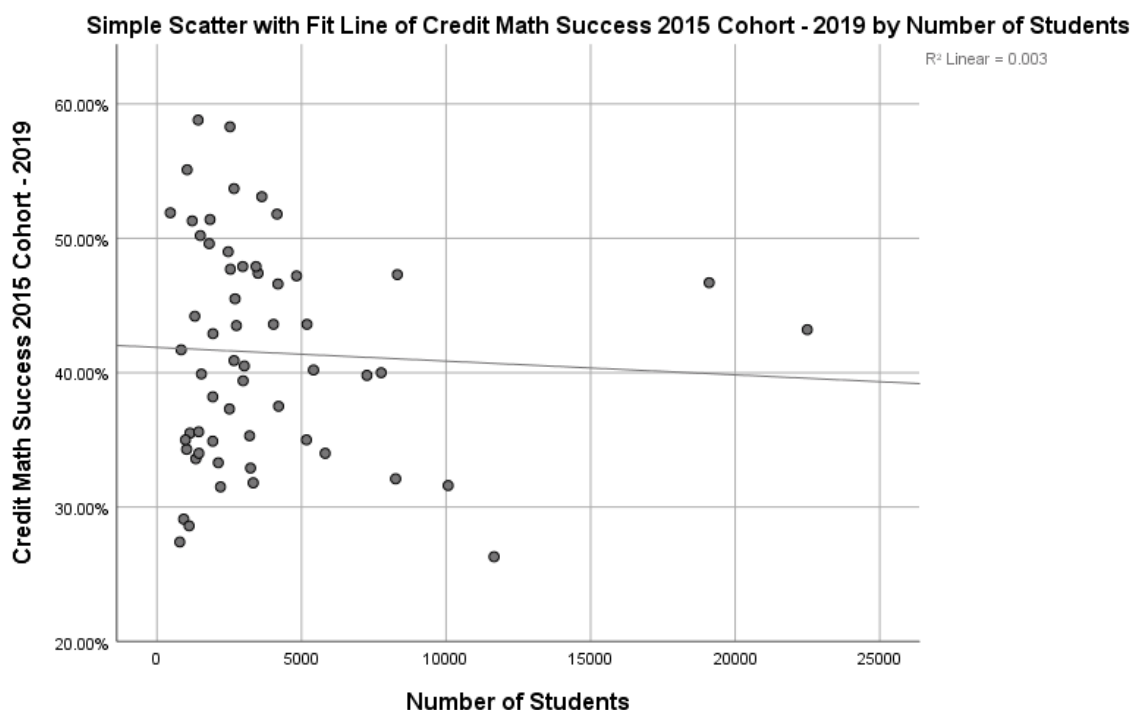
Figure E.3 Number of students vs. credit Math success performance measure
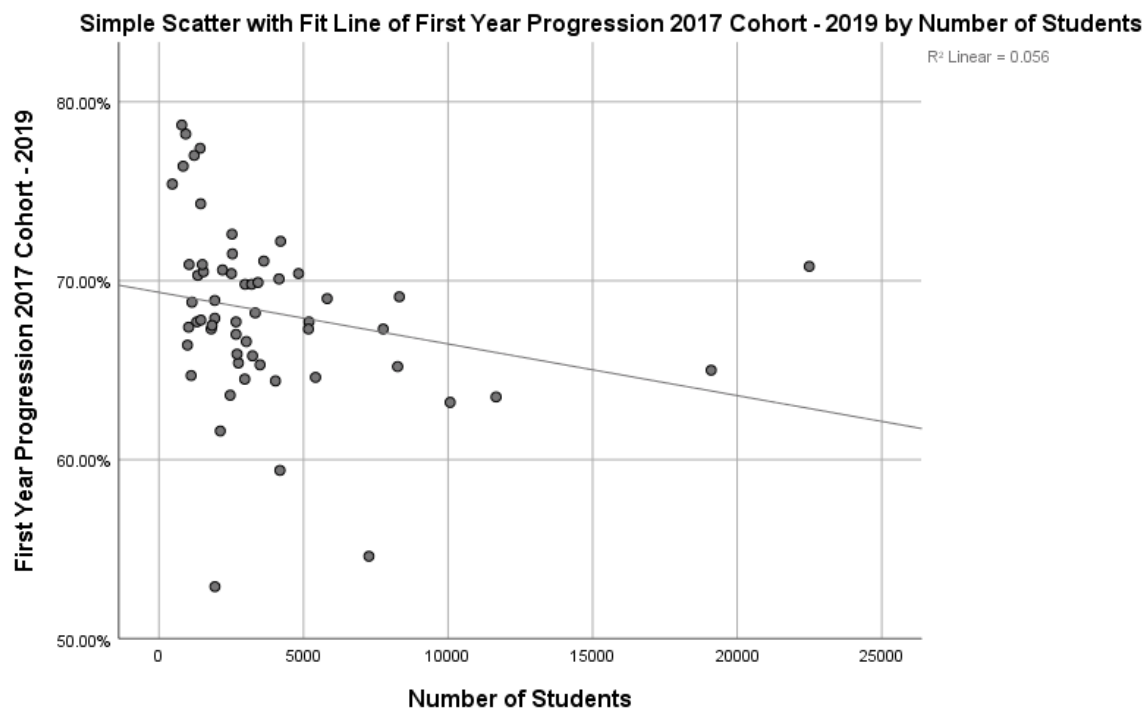
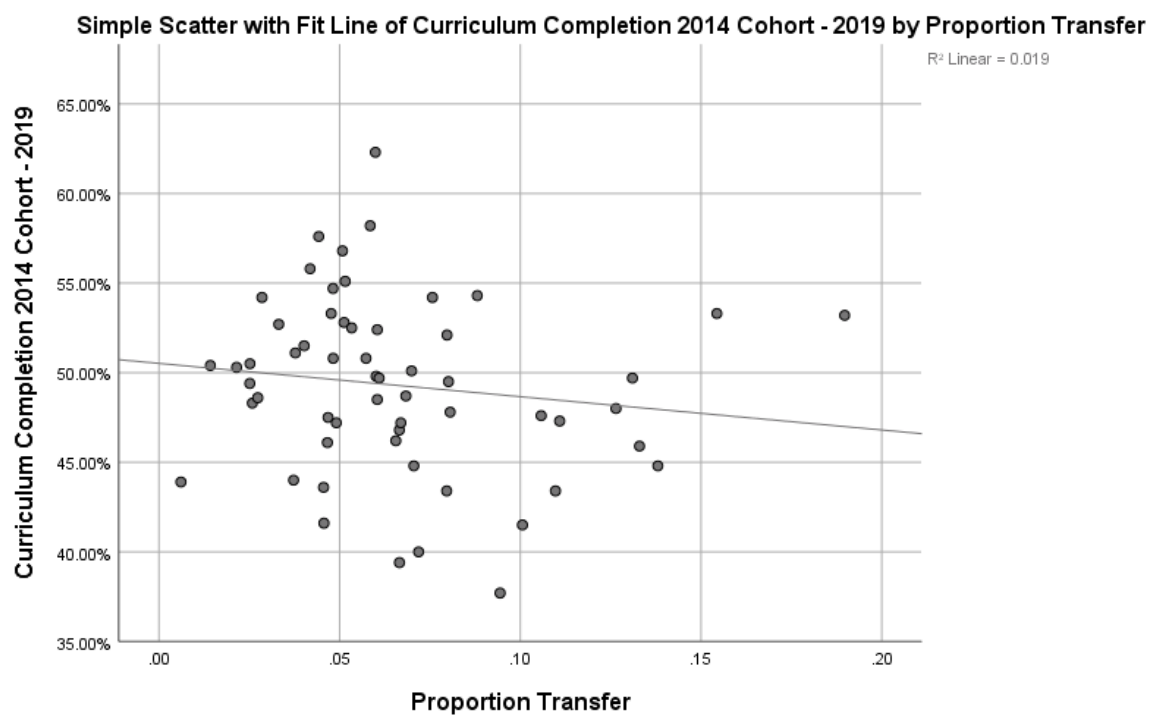*Figure E.4 Number of students vs. first year progression performance measure*
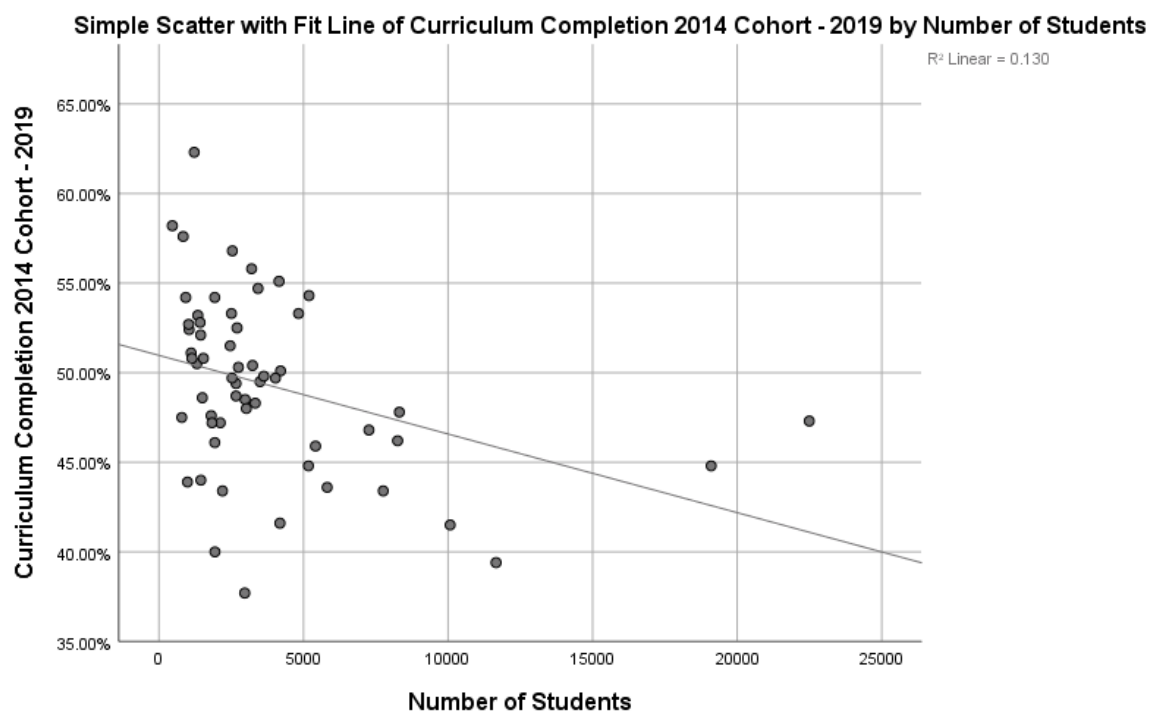
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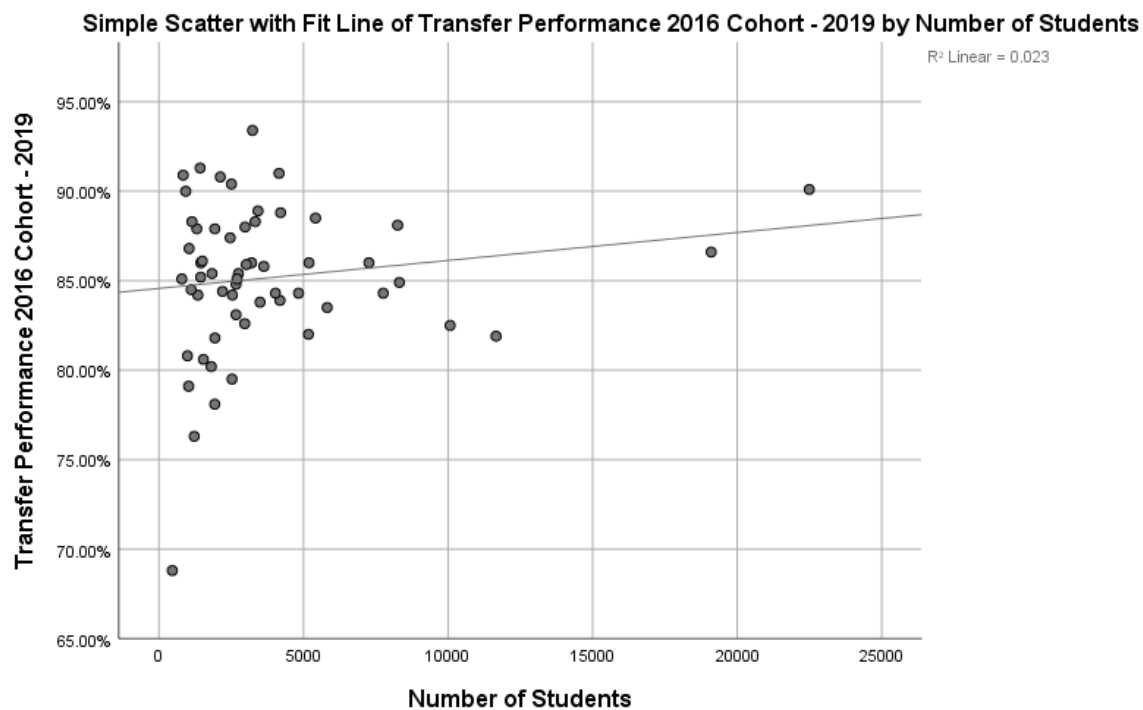
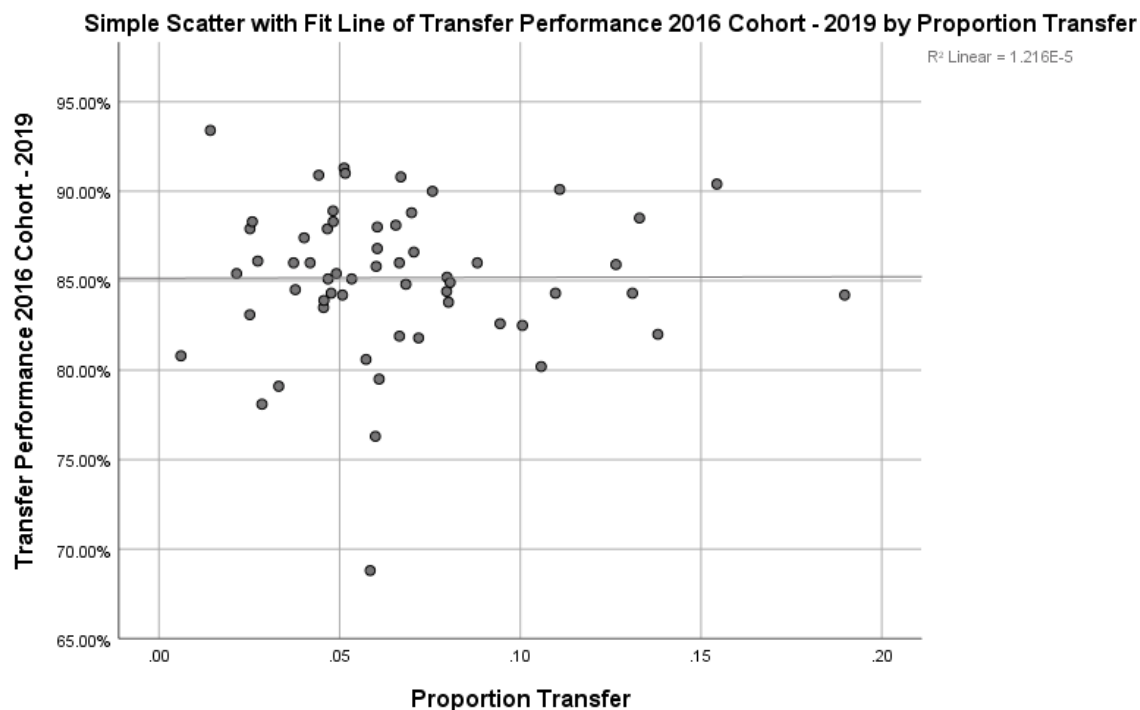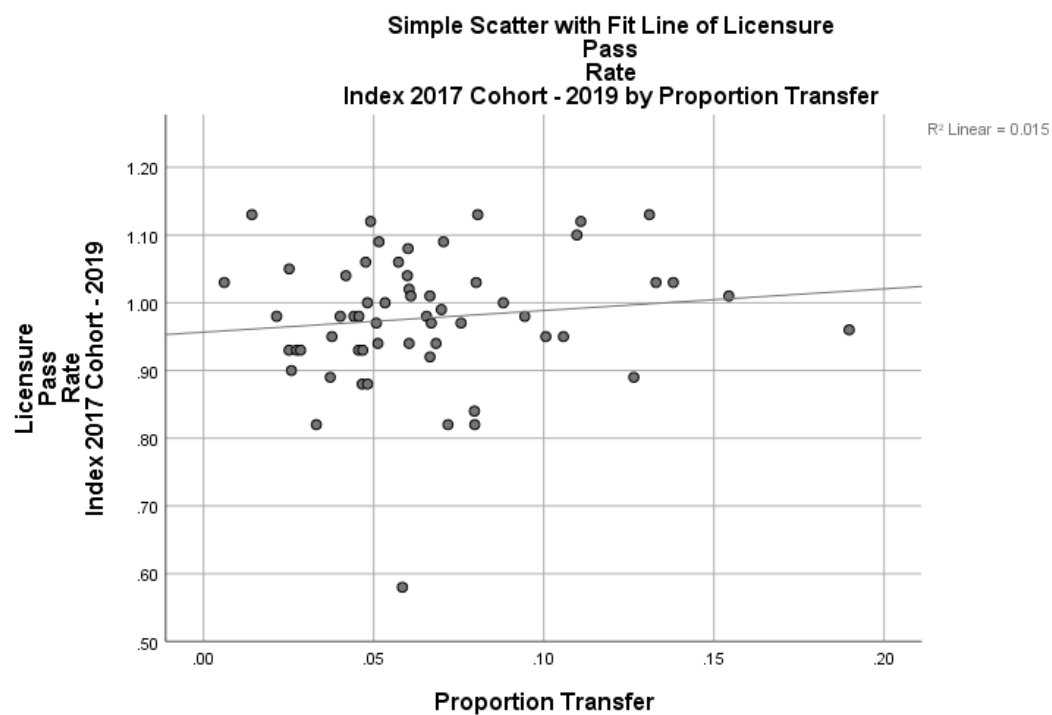*Figure E.6 Number of students vs. transfer performance success measure*
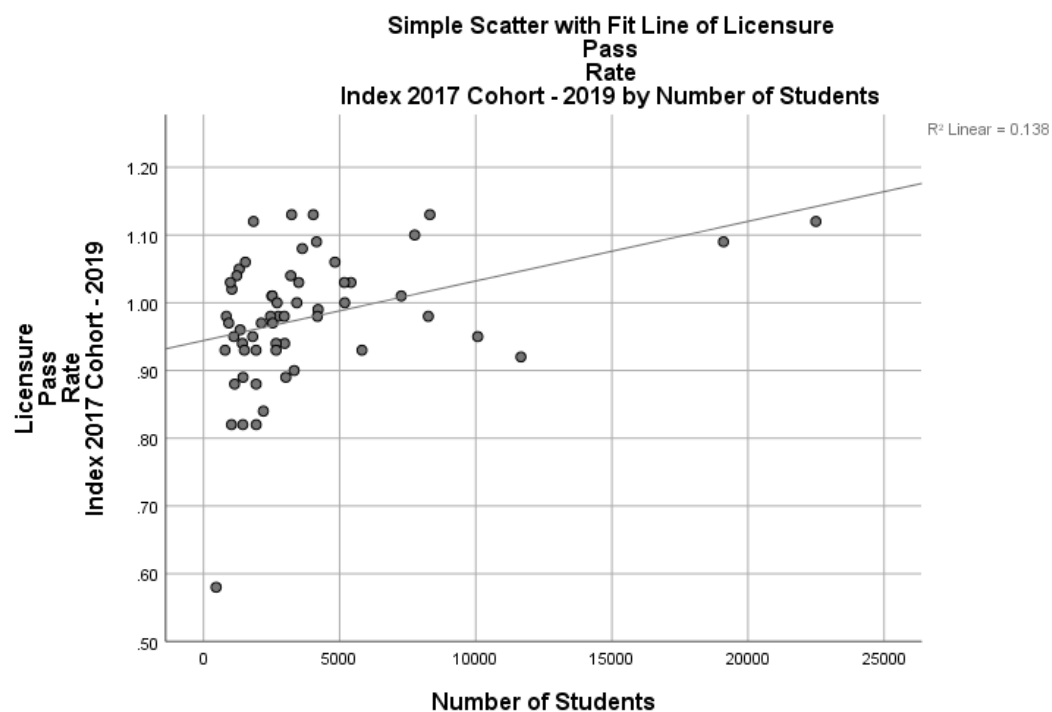
Figure E.7 Number of students vs. licensure pass rate performance measure

Appendix F: Scatterplots of Proportion of Student Receiving Pell vs. North Carolina

Community College Performance Measures

*Figure F.1 Proportion of students receiving Pell vs. basic-skills progress performance measure*

Figure F.2 Proportion of students receiving Pell vs. credit English success performance measure

Figure F.3 Proportion of students receiving Pell vs. credit Math success performance measure

Figure F.4 Proportion of students receiving Pell vs. first year progression performance measure

Figure F.5 Proportion of students receiving Pell vs. curriculum completion performance measure

Figure F.6 Proportion of students receiving Pell vs. transfer performance success measure

Figure F.7 Proportion of students receiving Pell vs. licensure pass rate performance measure

Appendix G: Scatterplots of Proportion of First-Time Students vs. North Carolina

Community College Performance Measures

Figure G.1 Proportion of first-time students vs. basic-skills progress performance measure
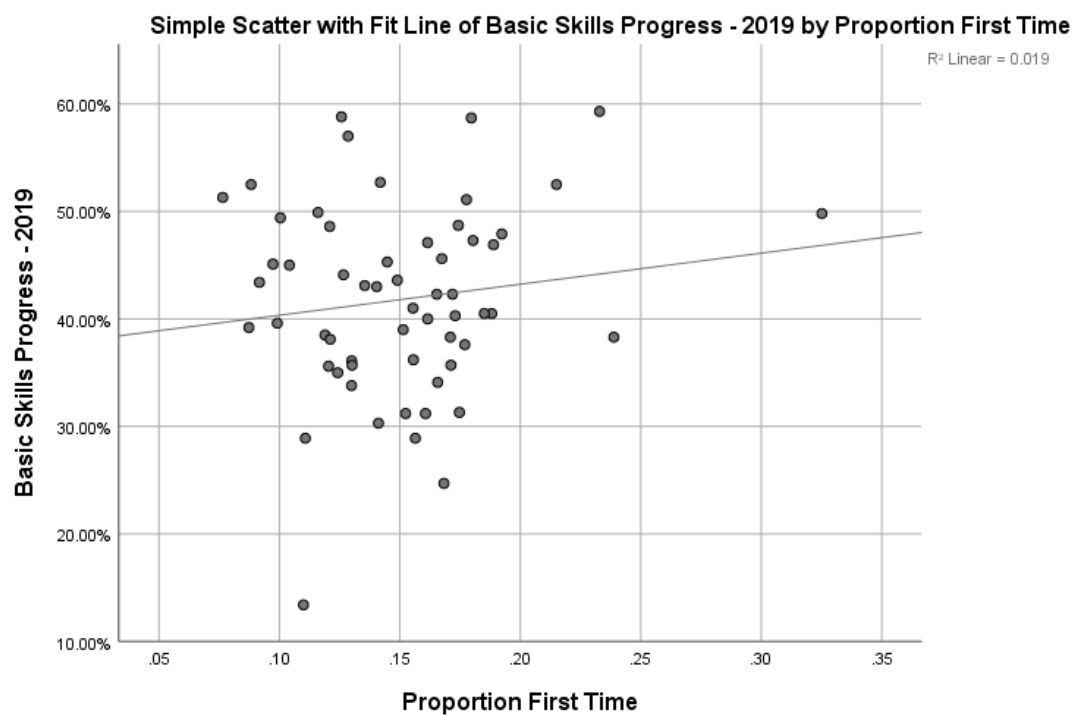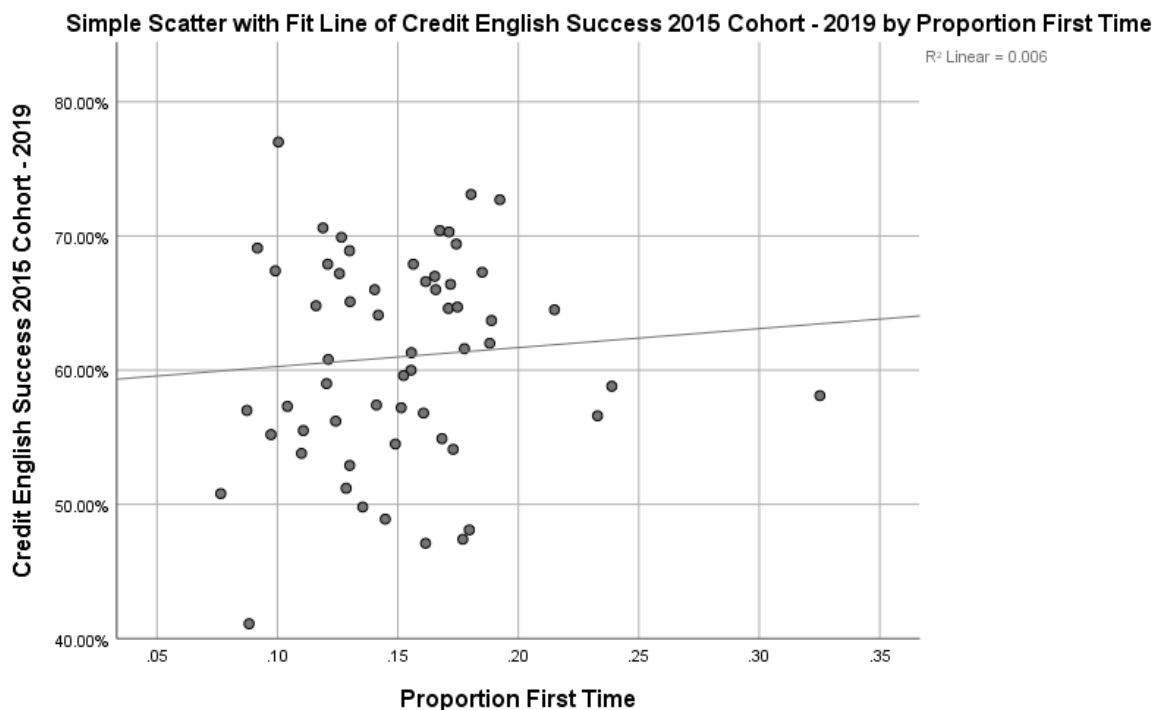
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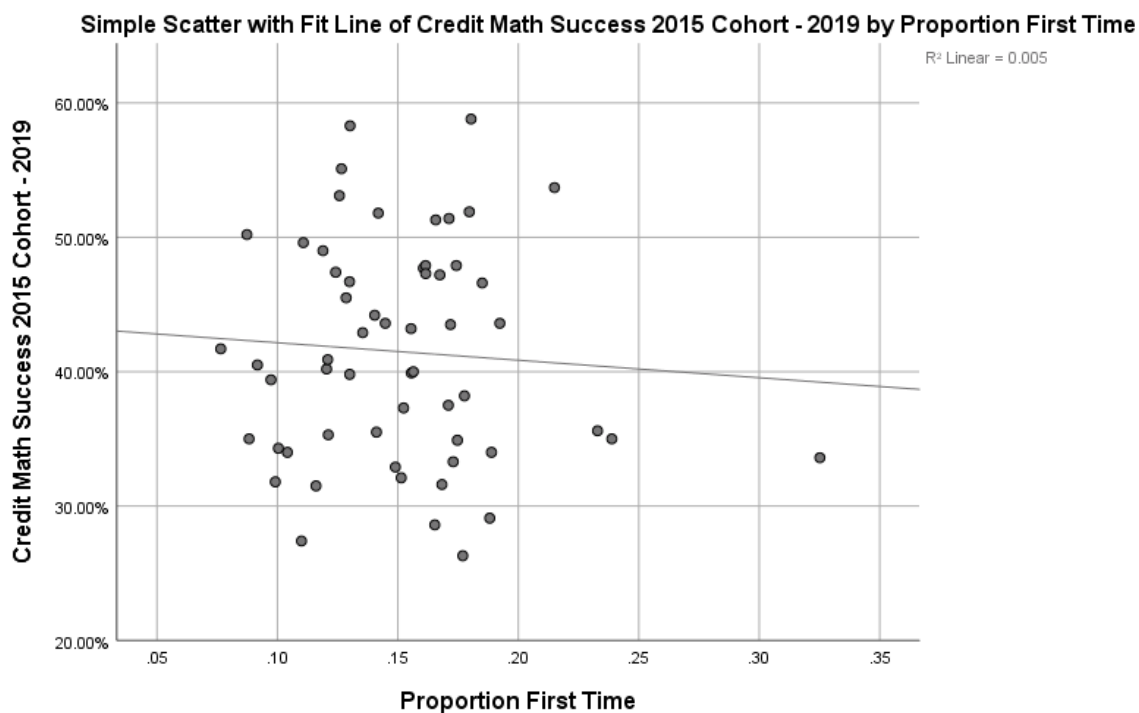
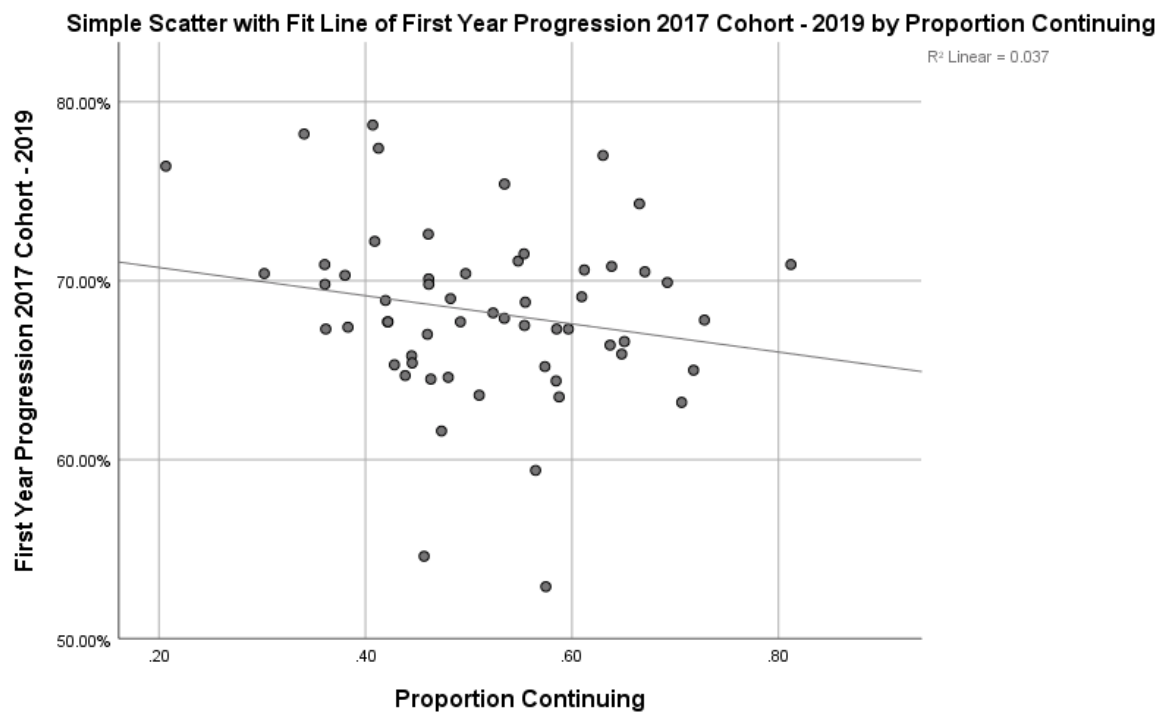*Figure G.3 Proportion of first-time students vs. credit Math success performance measure*
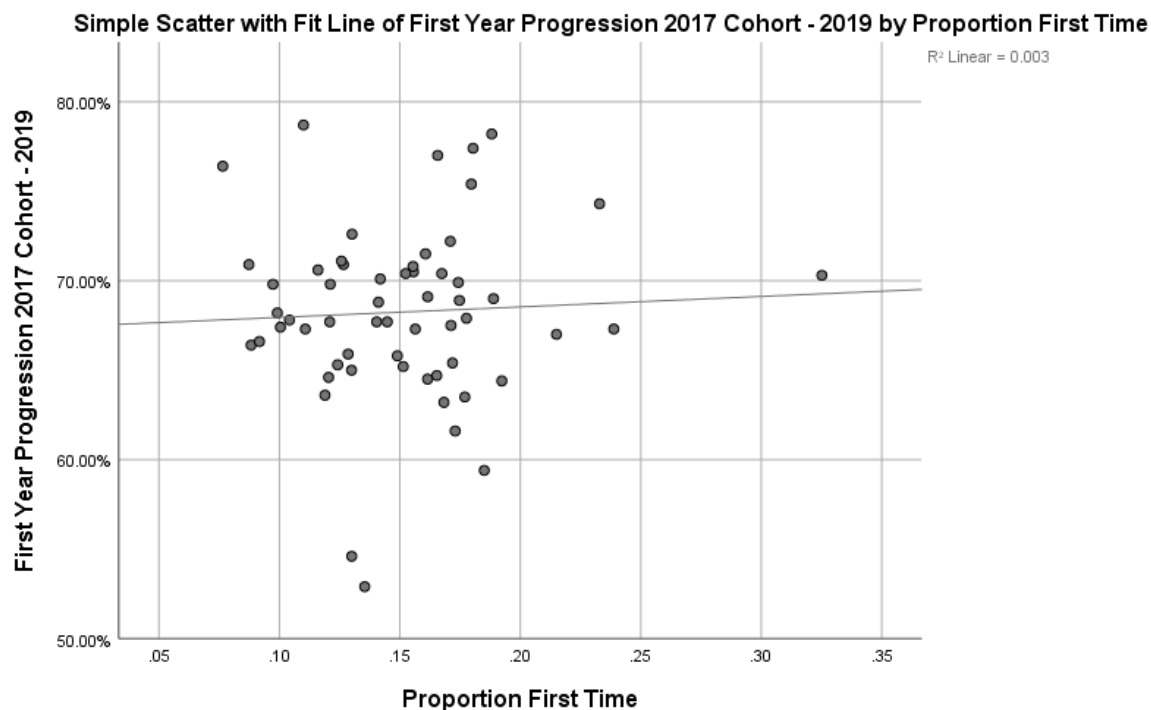
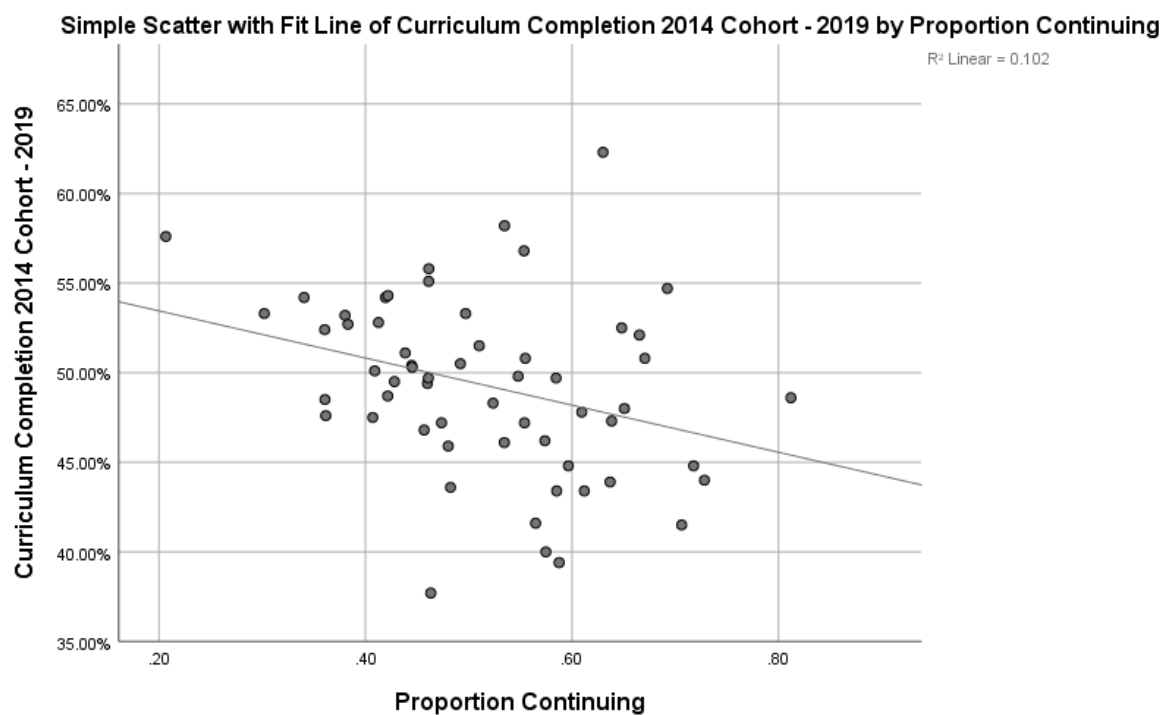*Figure G.4 Proportion of first-time students vs. first year progression performance measure*
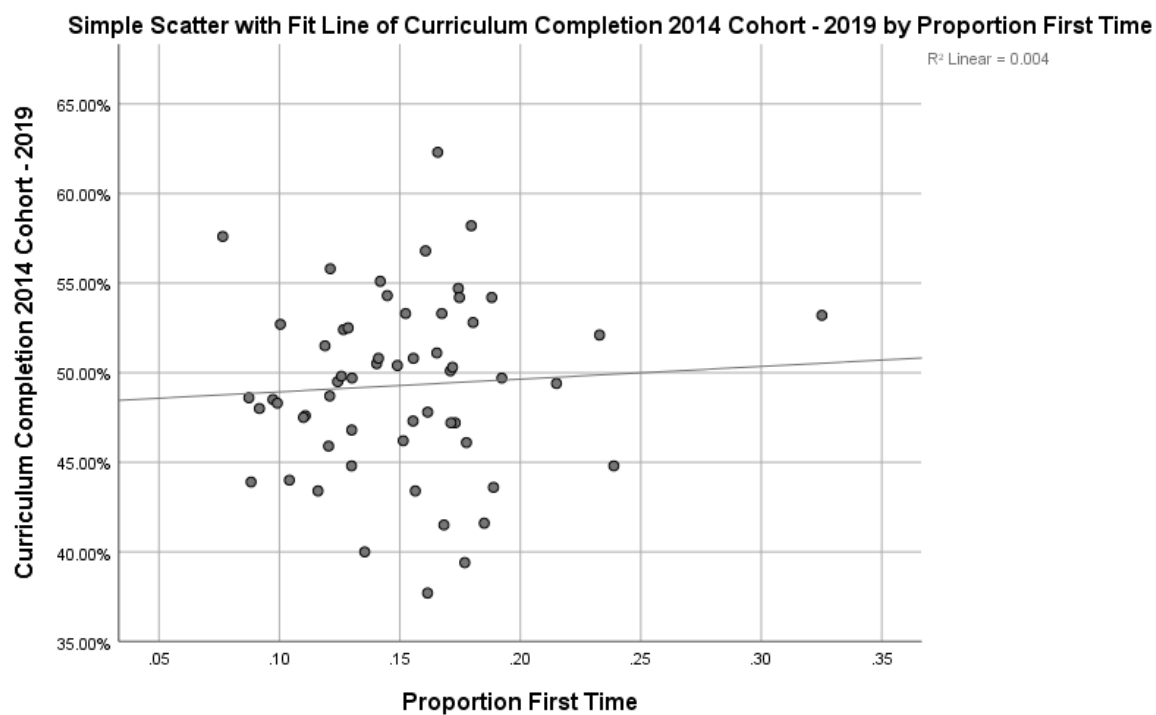
*Figure G.5 Proportion of first-time students vs. curriculum completion performance measure*
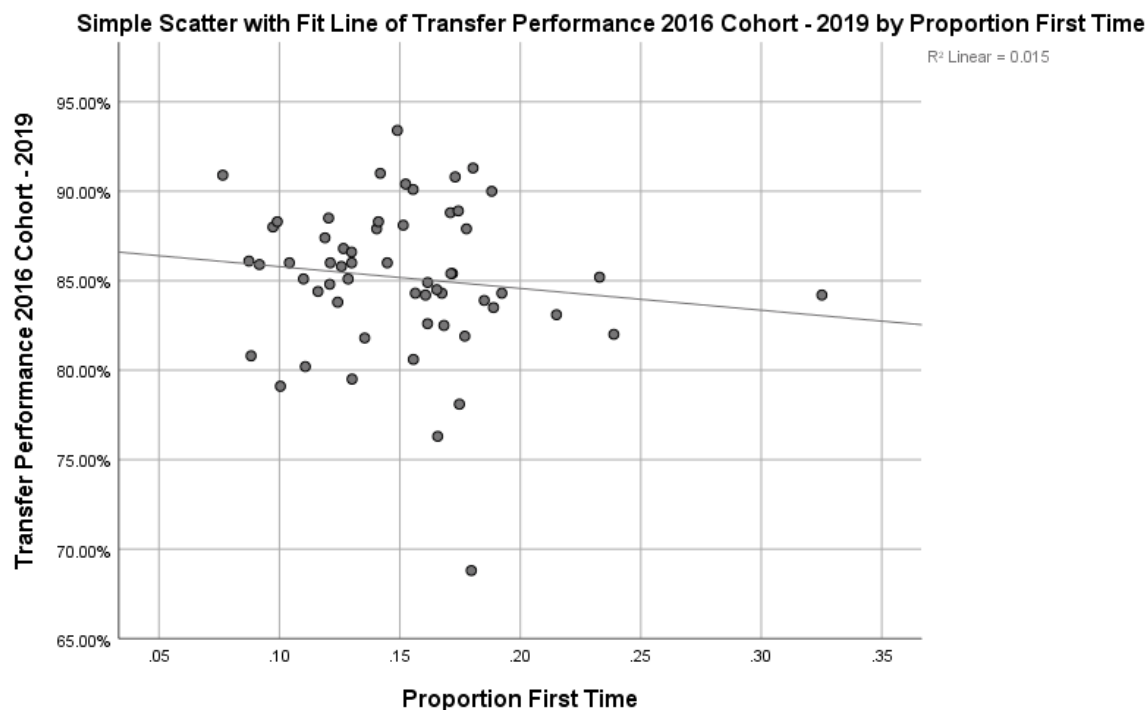
*Figure G.6 Proportion of first-time students vs. transfer performance success measure*
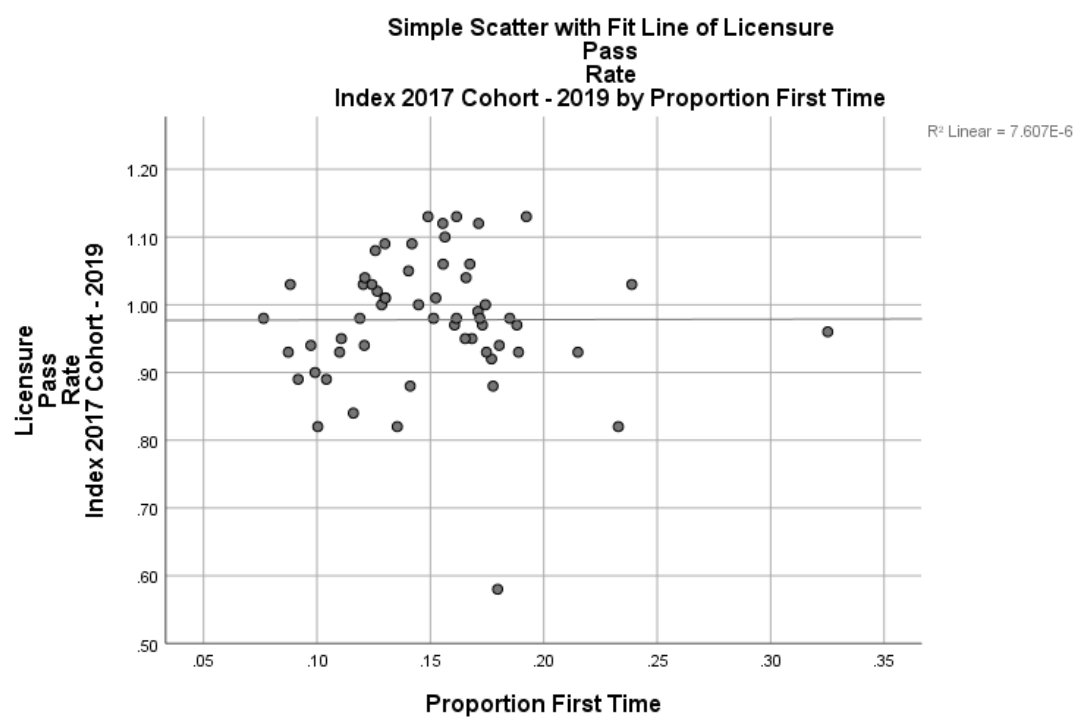
Figure G.7 Proportion of first-time students vs. licensure pass rate performance measure

Appendix H: Scatterplots of Proportion of Full-Time Students vs. North Carolina
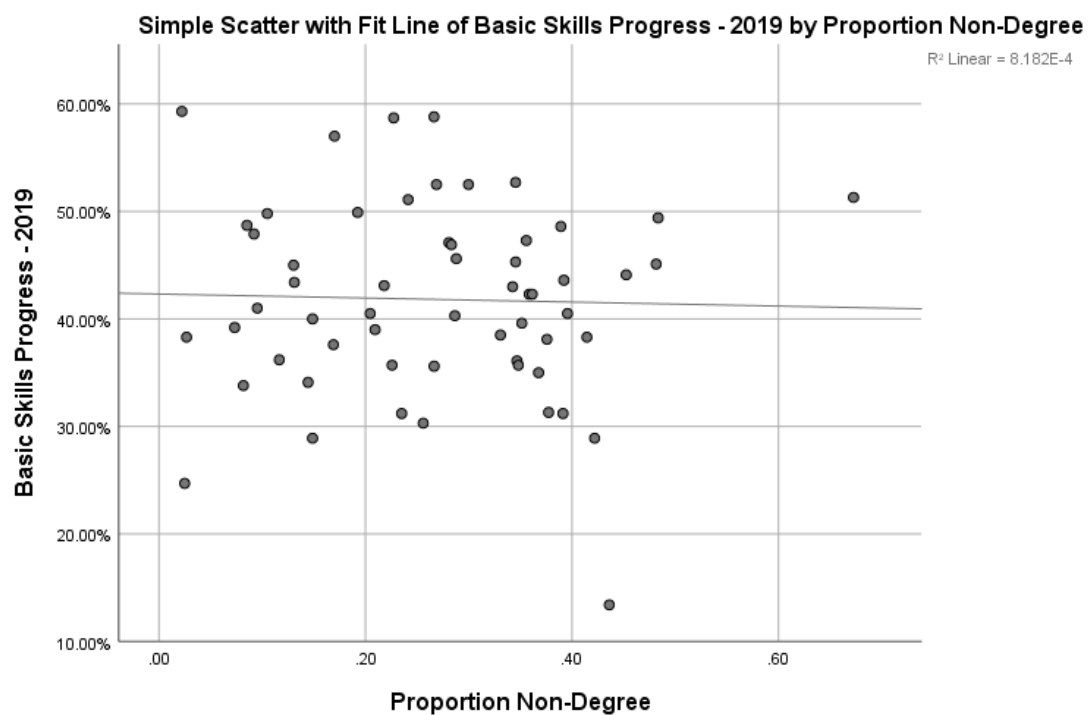
Community College Performance Measures
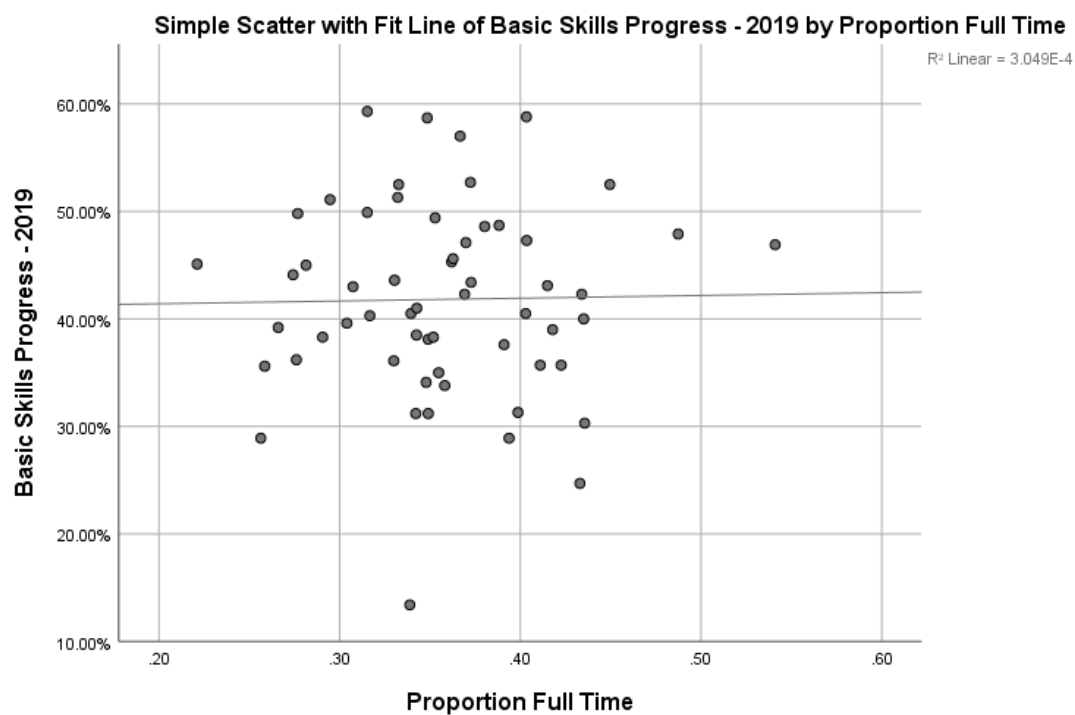
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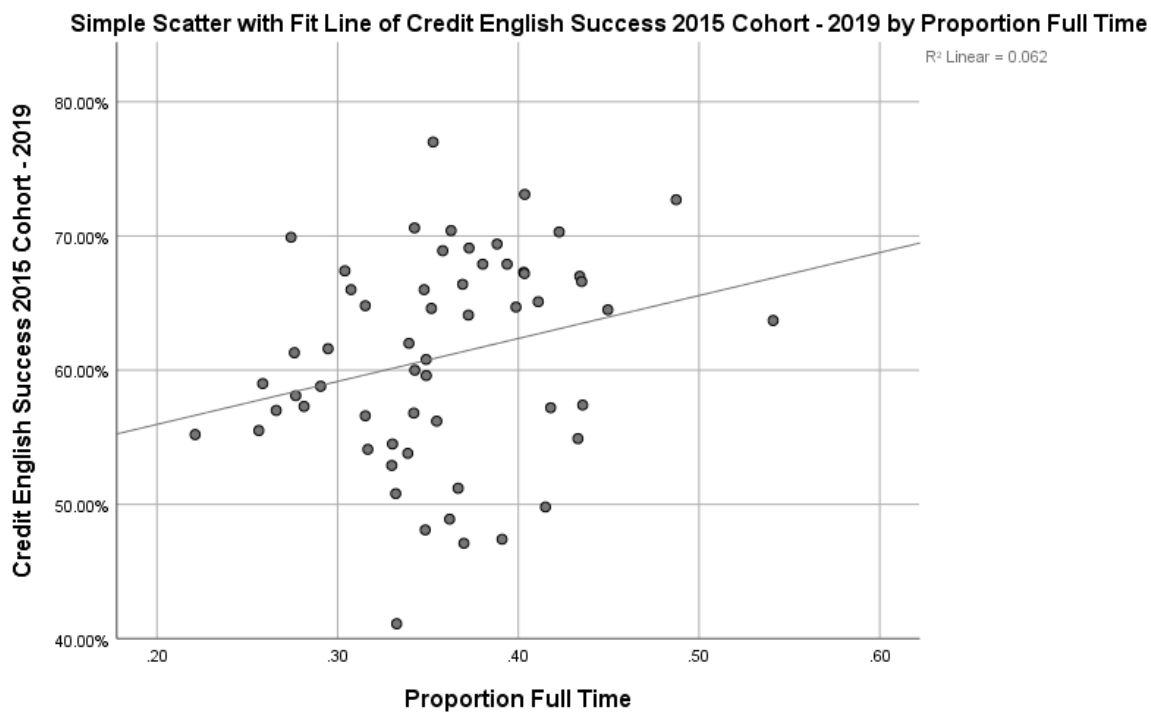
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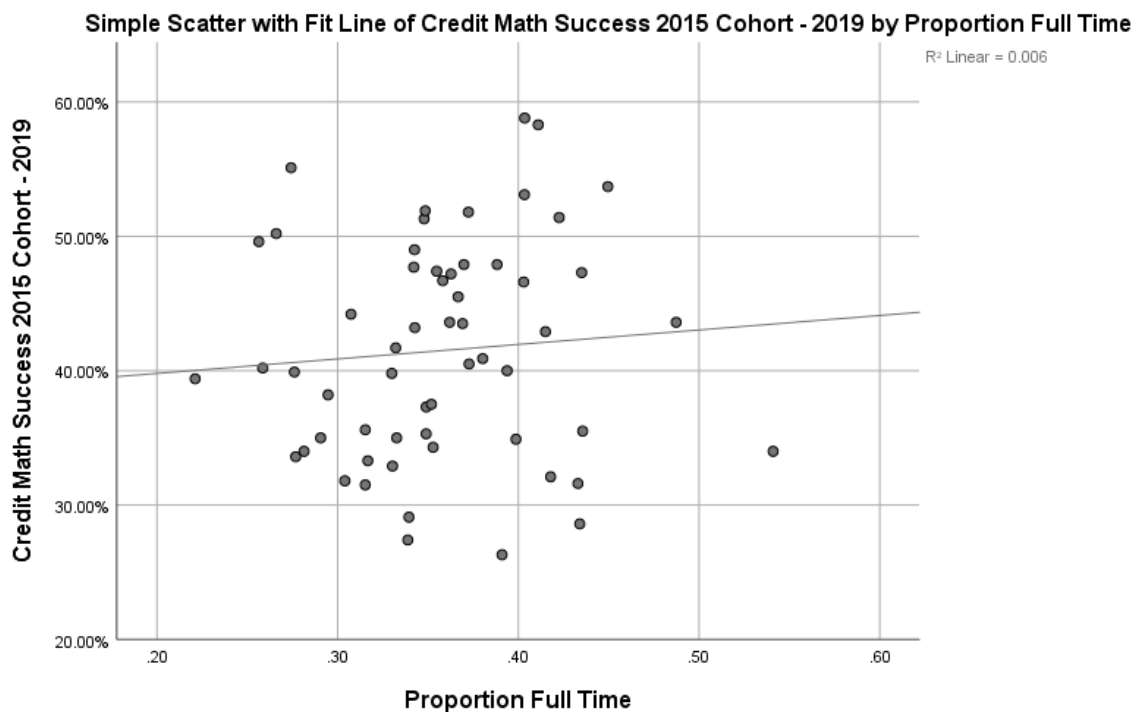
Figure H.3 Proportion of full-time students vs. credit Math success performance measure
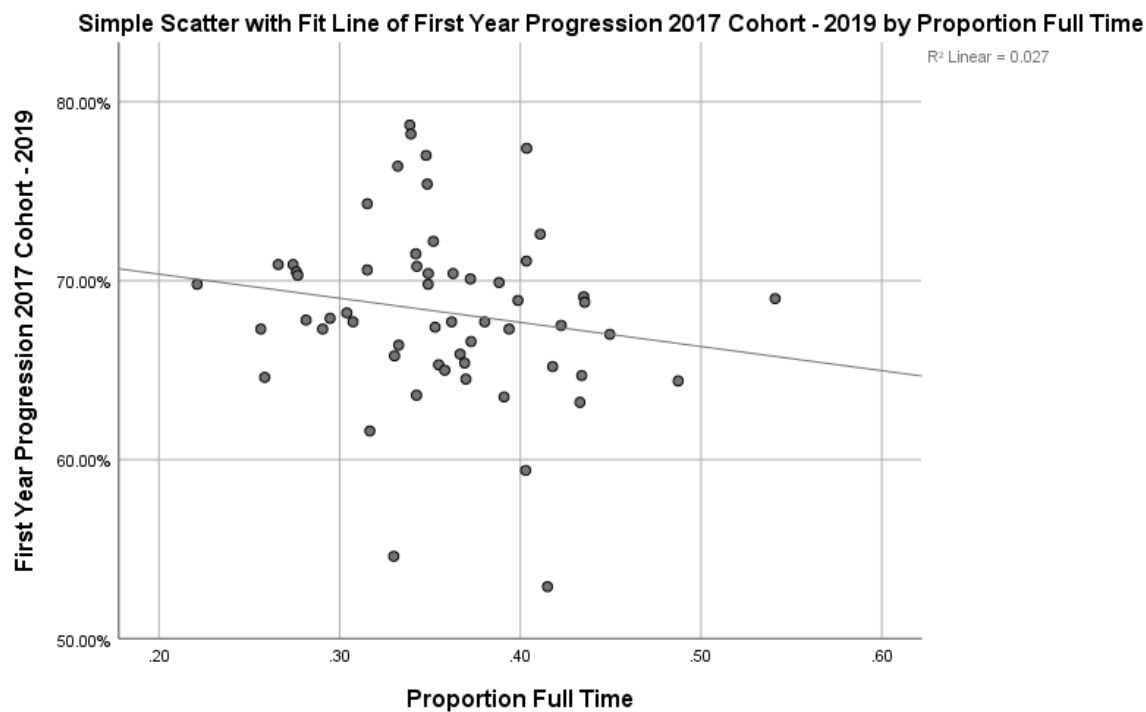
Figure H.4 Proportion of full-time students vs. first year progression performance measure
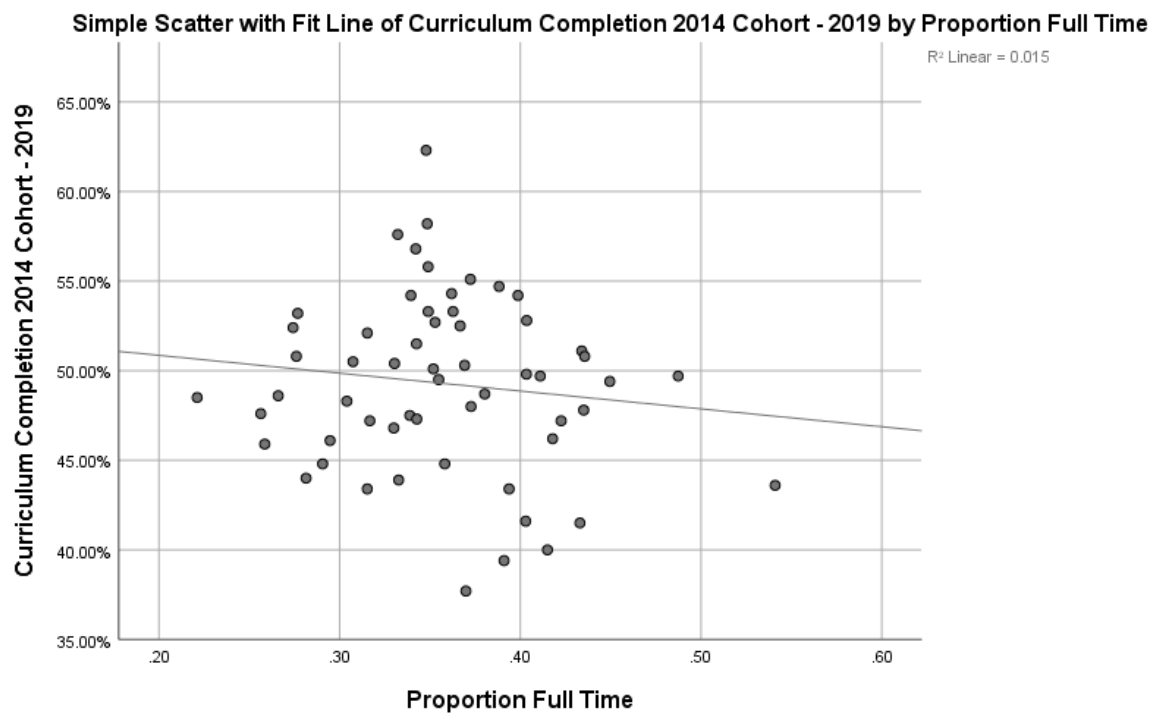
Figure H.5 Proportion of full-time students vs. curriculum completion performance measure
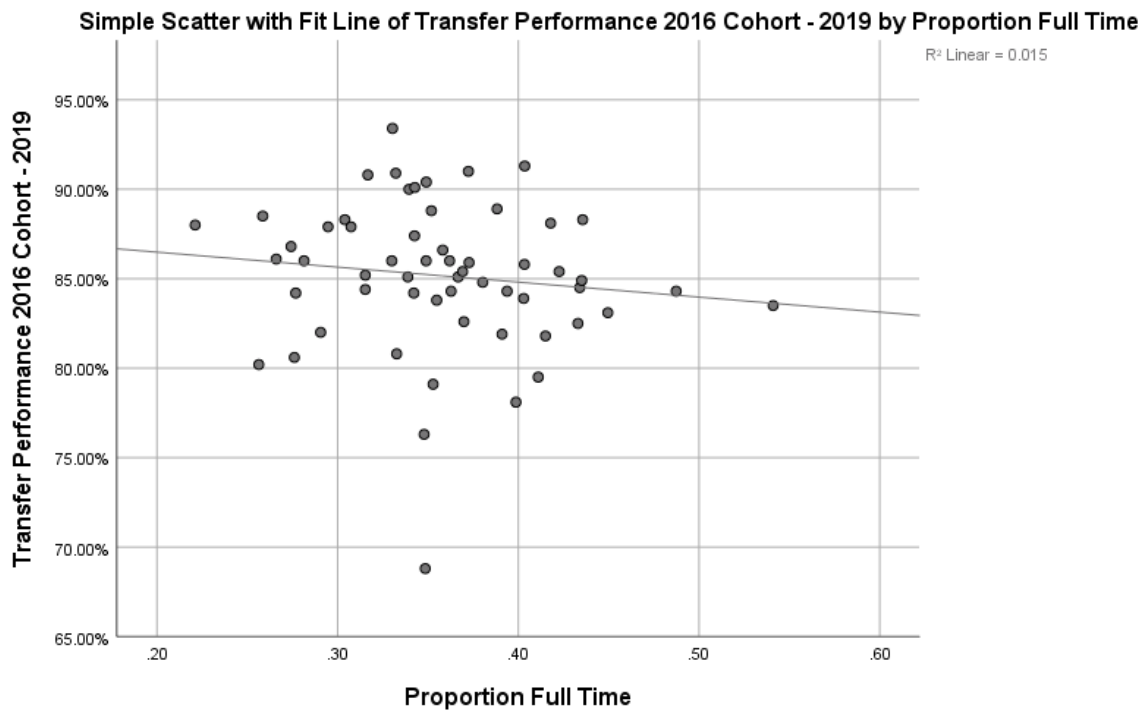
Figure H.6 Proportion of full-time students vs. transfer performance success measure
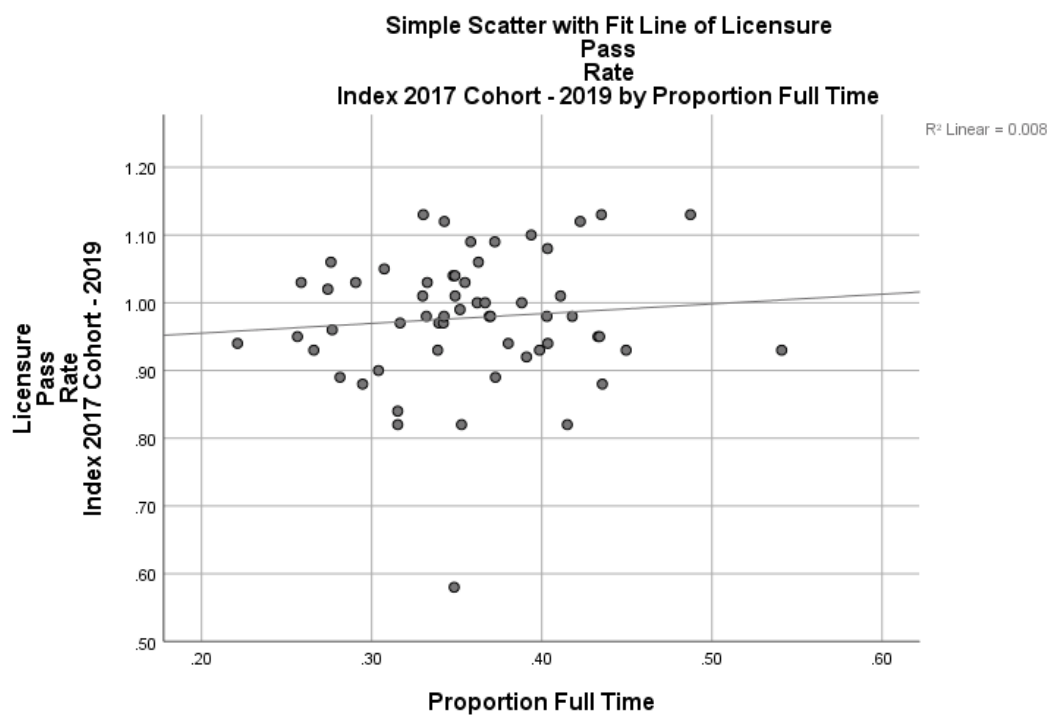
Figure H.7 Proportion of full-time students vs. licensure pass rate performance measure

Appendix I: Scatterplots of Proportion of First-Time, Full-Time Students vs. North

Carolina Community College Performance Measures
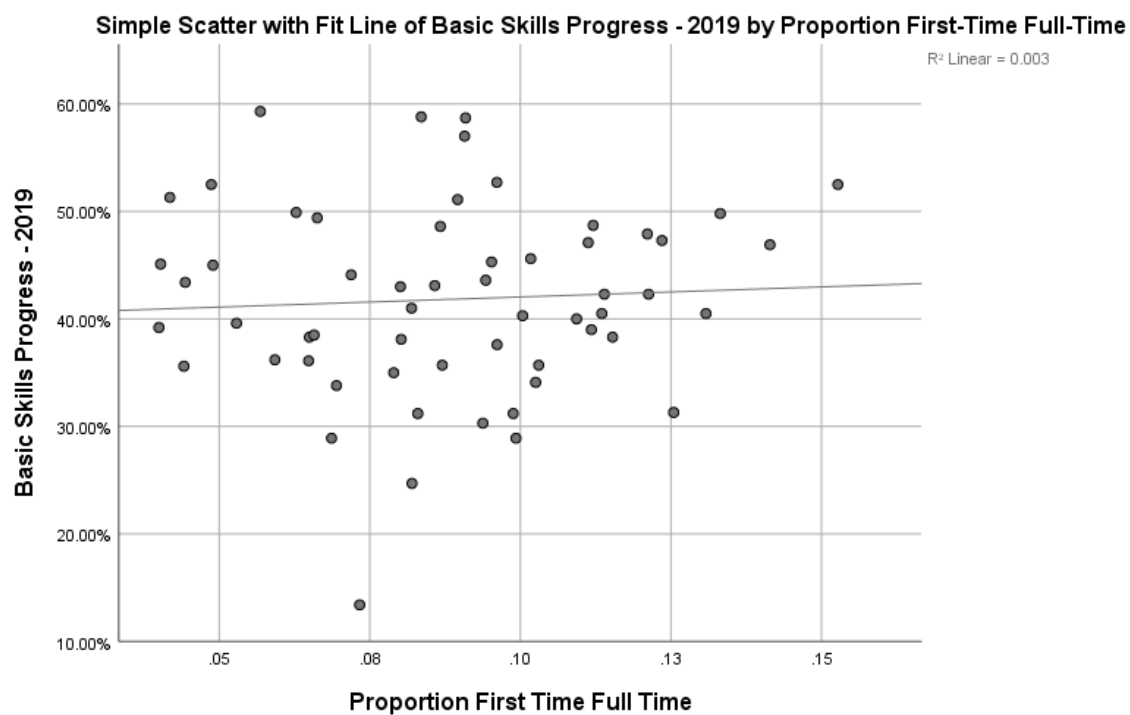
Figure I.1 Proportion of first-time, full-time students vs. basic-skills progress performance measure
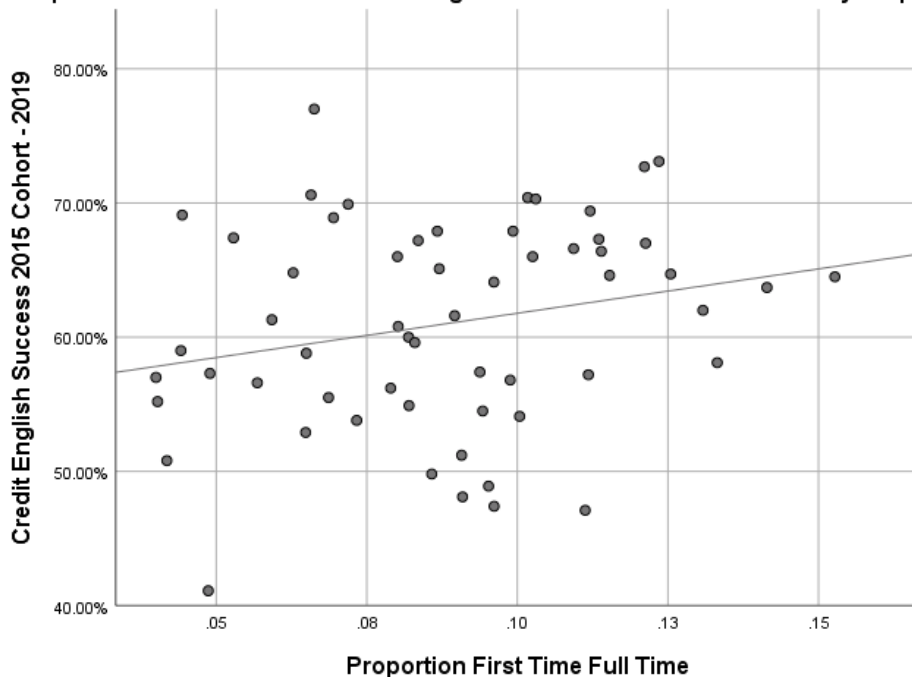
Figure I.2 Proportion of first-time, full-time students vs. credit English success performance measure
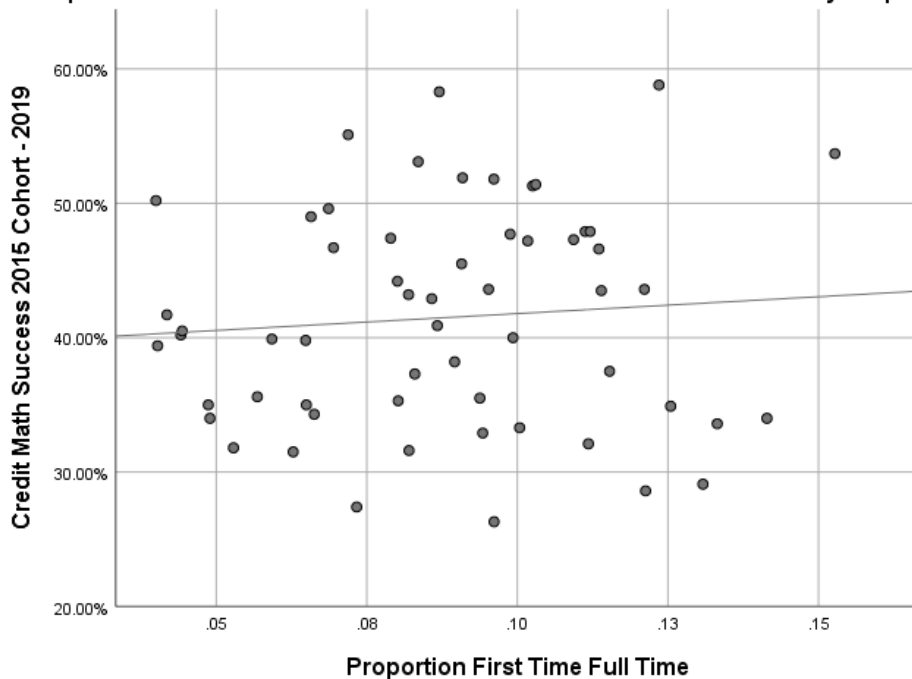
*Figure I.3 Proportion of first-time, full-time students vs. credit Math success performance measure*

Simple Scatter with Fit Line of First Year Progression 2017 Cohort - 2019 by Proportion First-Time Full-Time

R² Linear = 4.798E-4
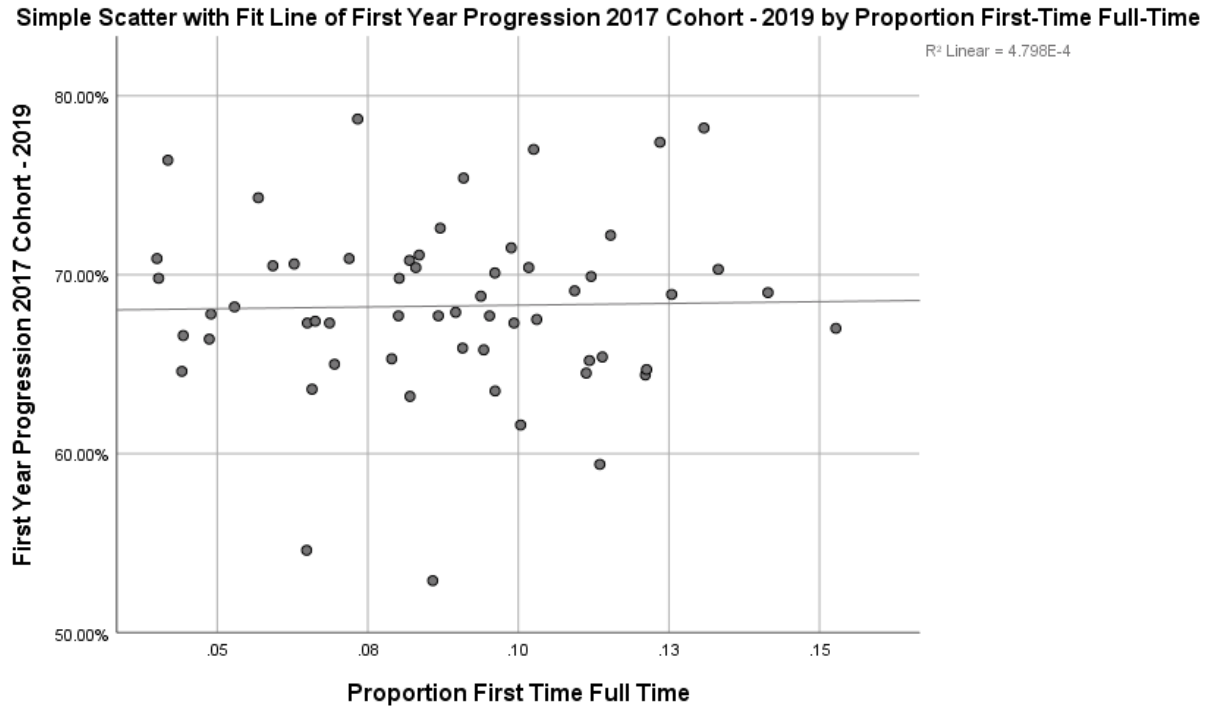
Figure I.4 Proportion of first-time, full-time students vs. first year progression performance measure

Simple Scatter with Fit Line of Curriculum Completion 2014 Cohort - 2019 by Proportion First-Time Full-Time

R² Linear = 0.012
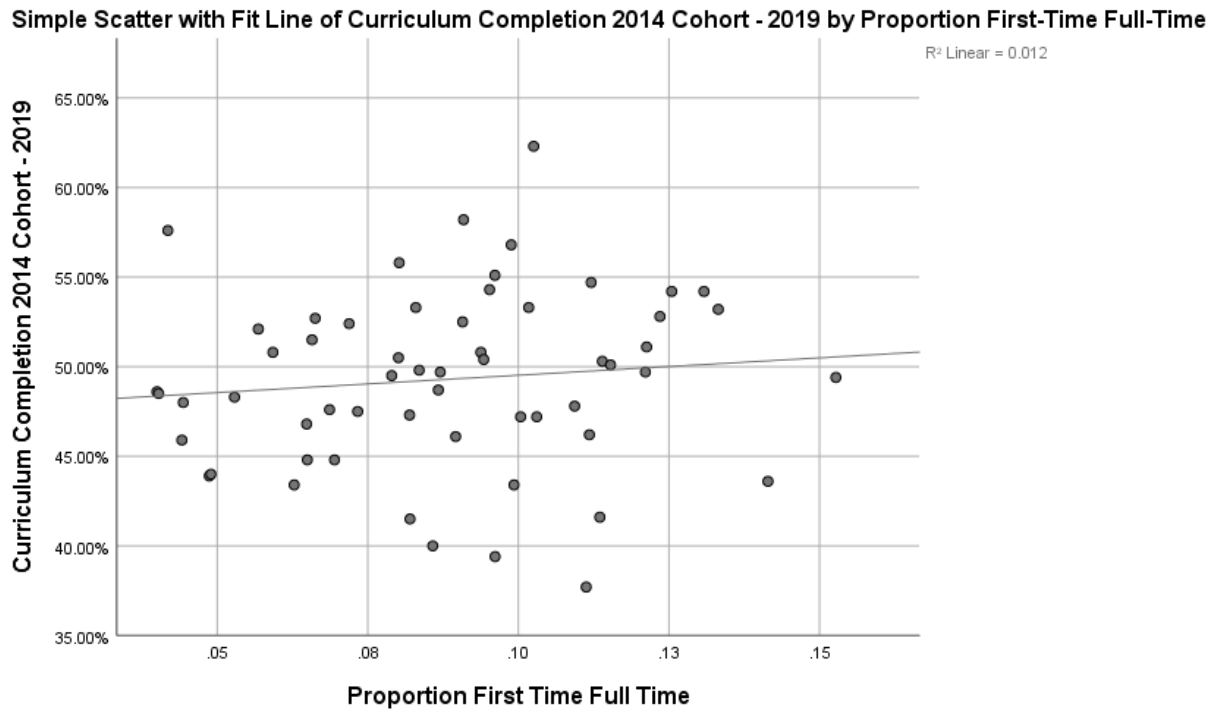
Figure I.5 Proportion of first-time, full-time students vs. curriculum completion performance measure
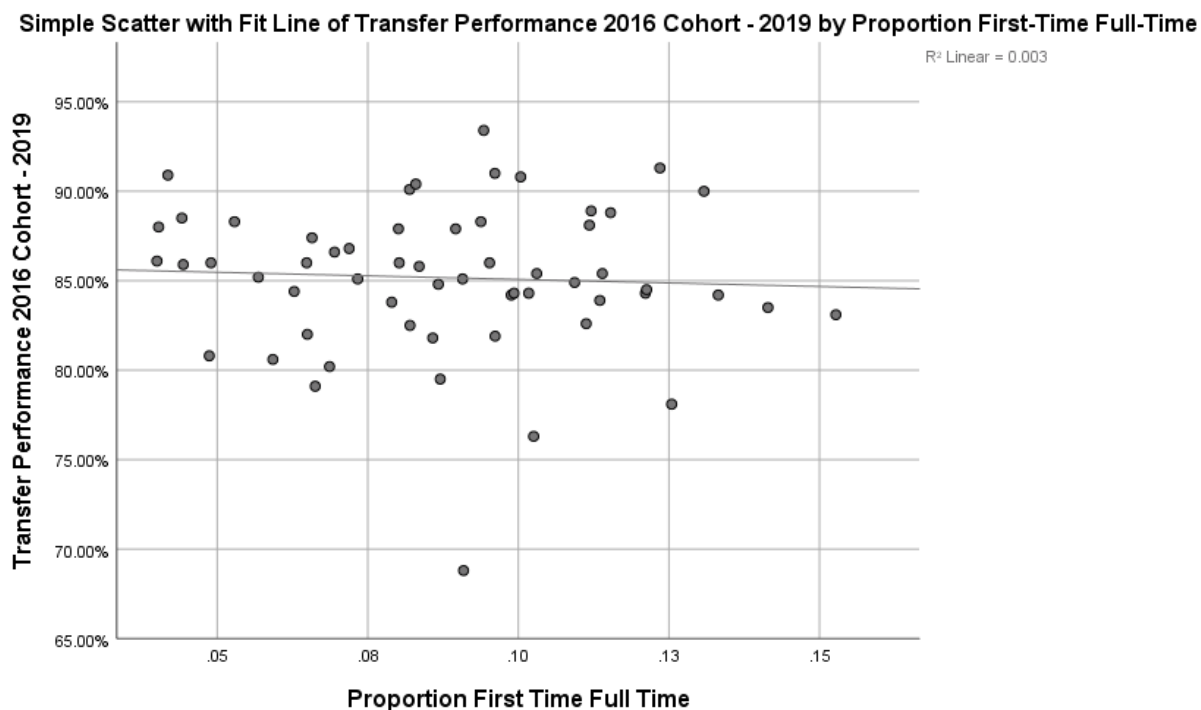
*Figure I.6 Proportion of first-time, full-time students vs. transfer performance success measure*
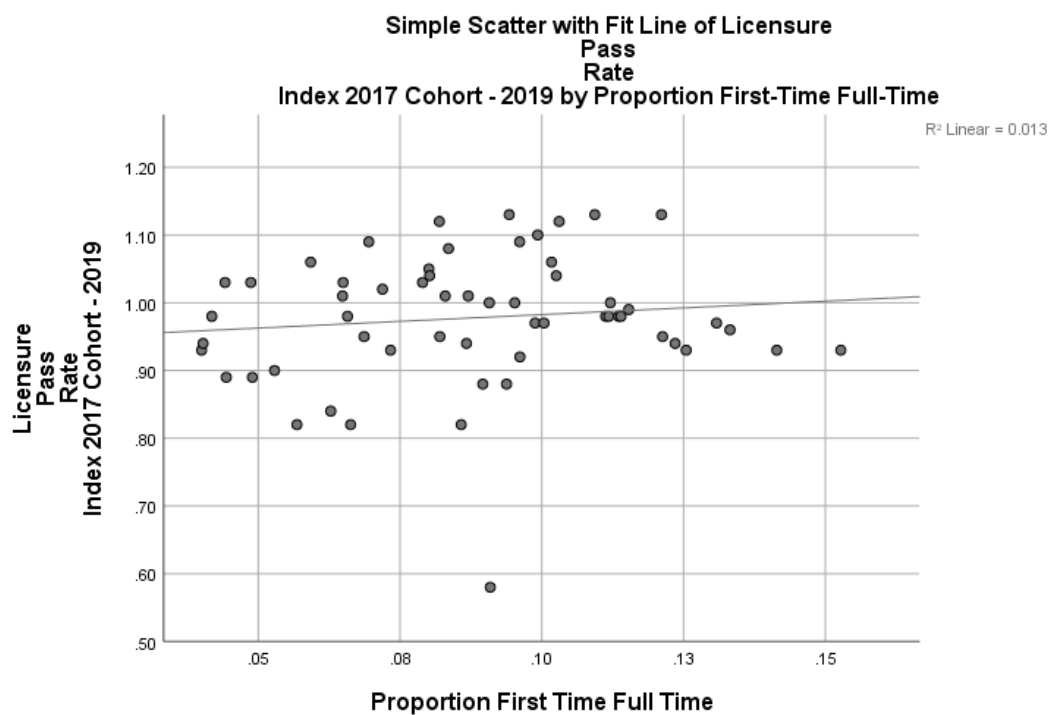
Figure I.7 Proportion of full-time students vs. licensure pass rate performance measure

Appendix J: Scatterplots of Proportion of Transfer Students vs. North Carolina

Community College Performance Measures
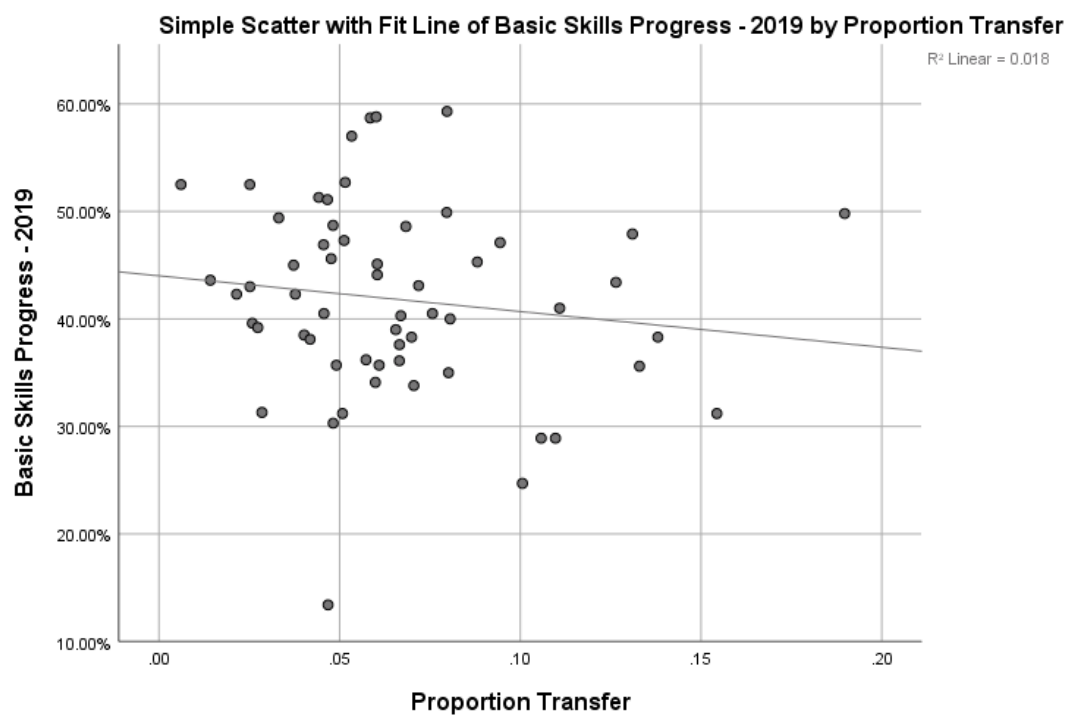
Figure J.1 Proportion of transfer students vs. basic-skills progress performance measure
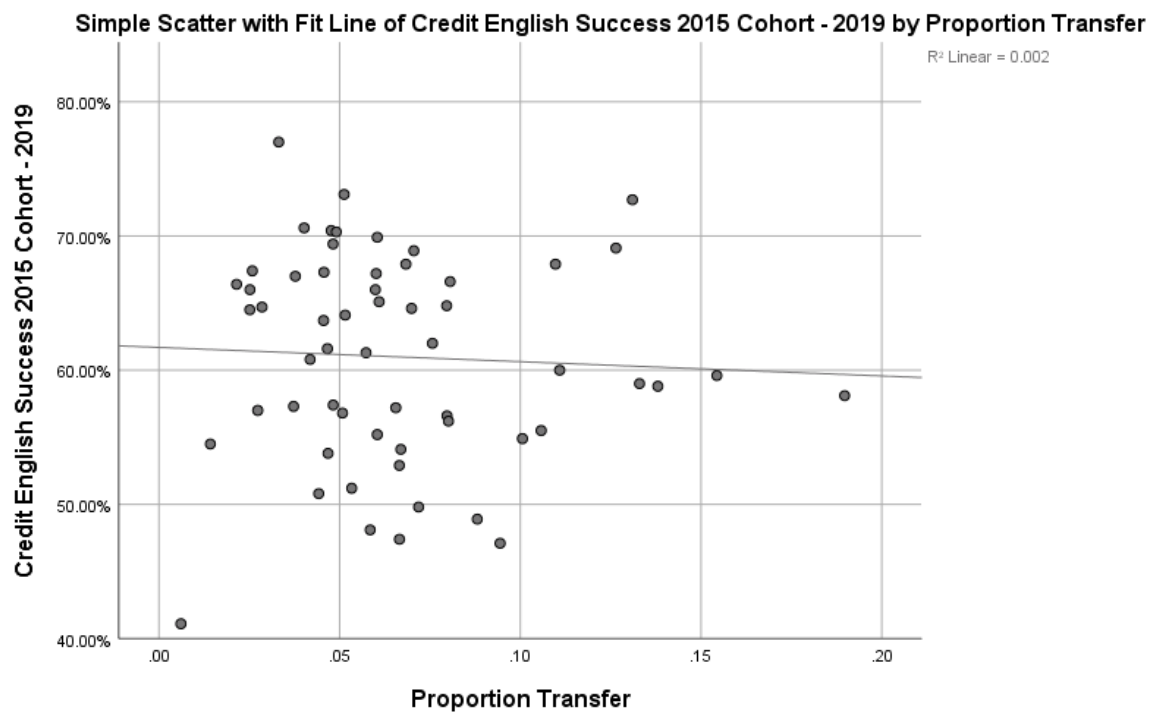
Figure J.2 Proportion of transfer vs. credit English success performance measure
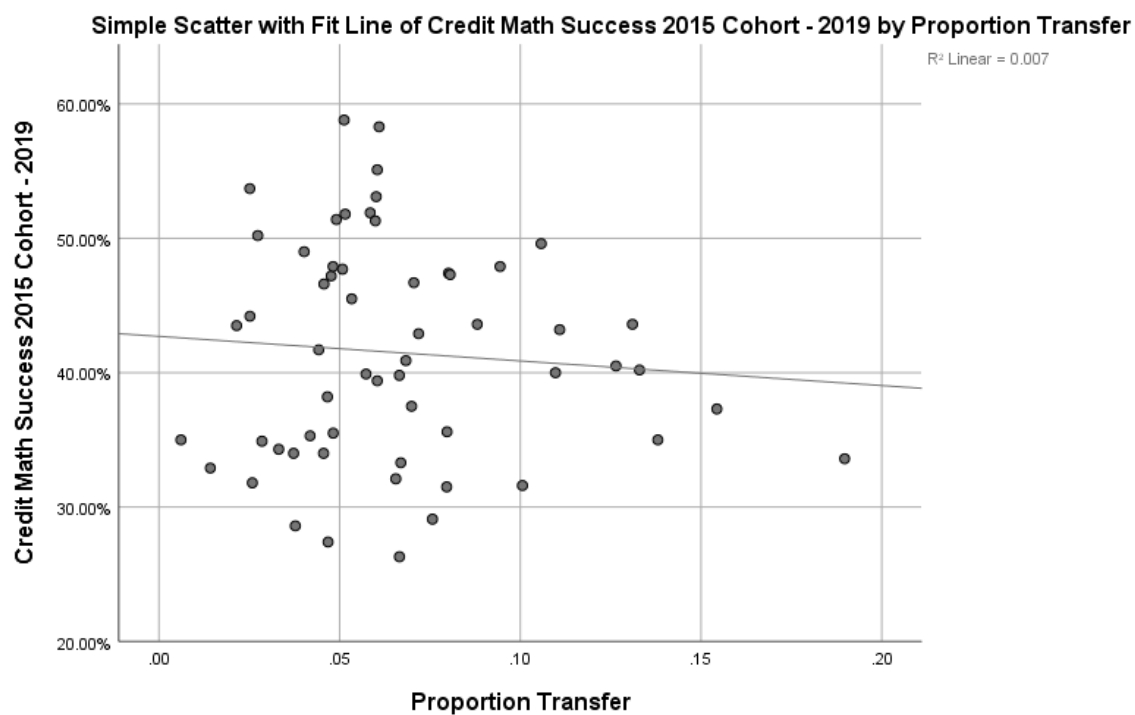
Figure J.3 Proportion of transfer students vs. credit Math success performance measure
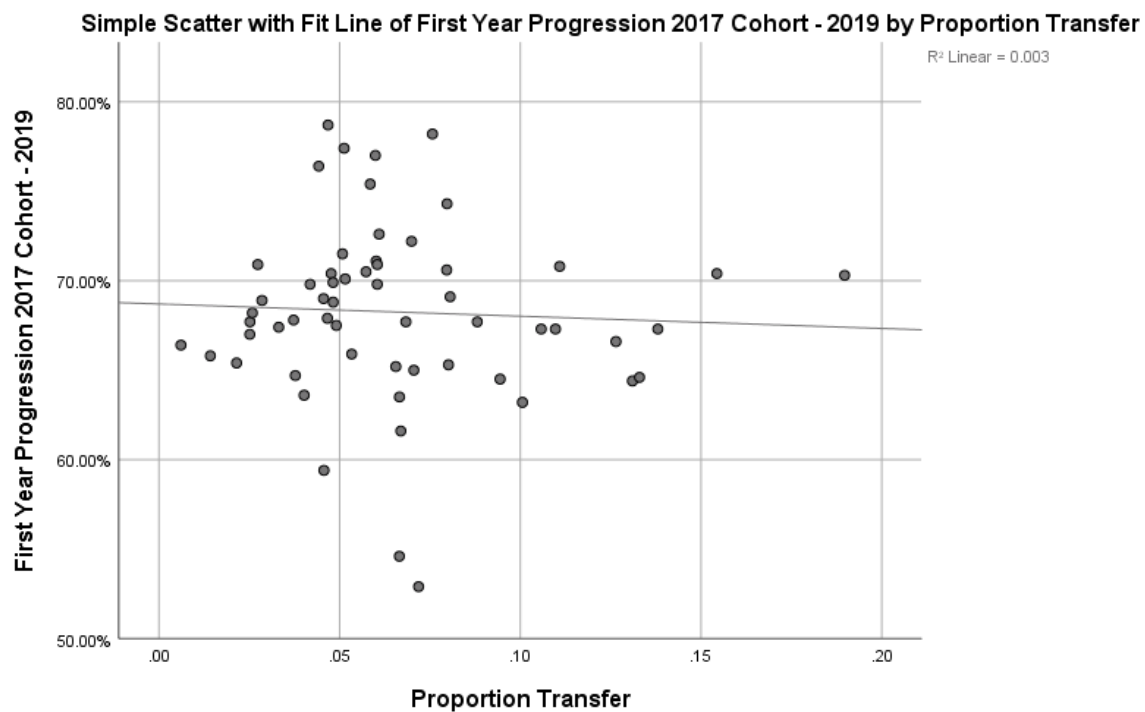
Figure J.4 Proportion of transfer students vs. first year progression performance measure

Figure J.5 Proportion of transfer students vs. curriculum completion performance measure

Figure J.6 Proportion of transfer students vs. transfer performance success measure

Figure J.7 Proportion of transfer students vs. licensure pass rate performance measure

Appendix K: Scatterplots of Proportion of Continuing Students vs. North Carolina

Community College Performance Measures
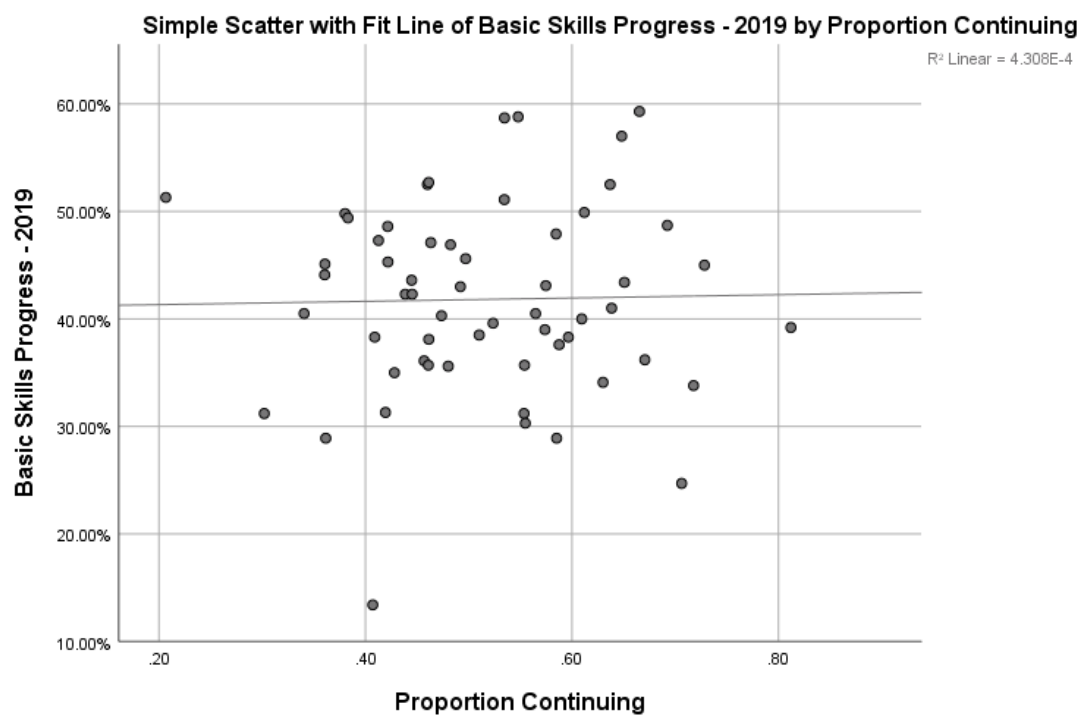
Figure K.1 Proportion of continuing students vs. basic-skills progress performance measure
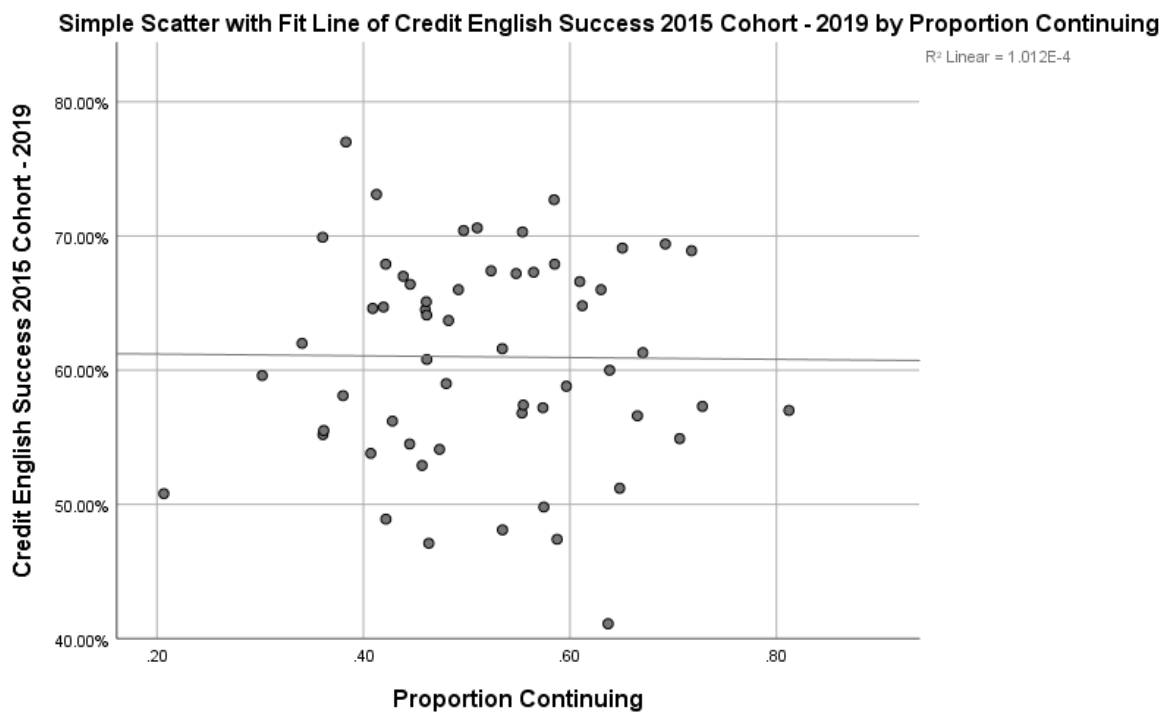
Figure K.2 Proportion of continuing vs. credit English success performance measure
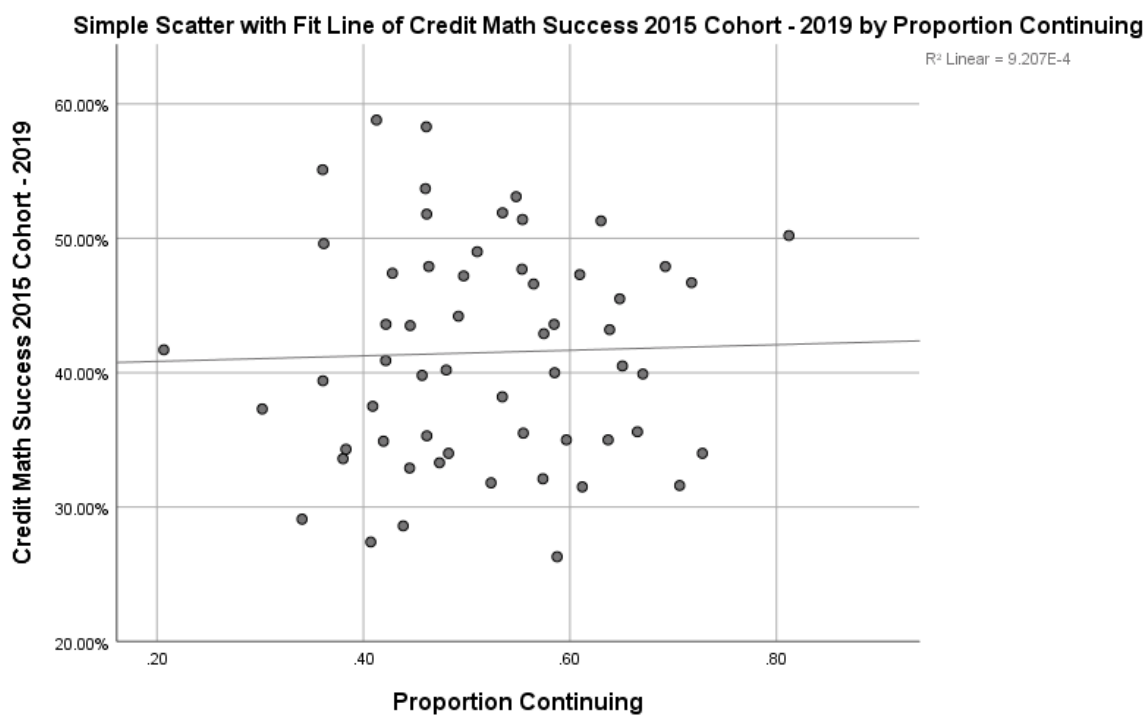
Figure K.3 Proportion of continuing students vs. credit Math success performance measure

Figure K.4 Proportion of continuing students vs. first year progression performance measure

Figure K.5 Proportion of continuing students vs. curriculum completion performance measure
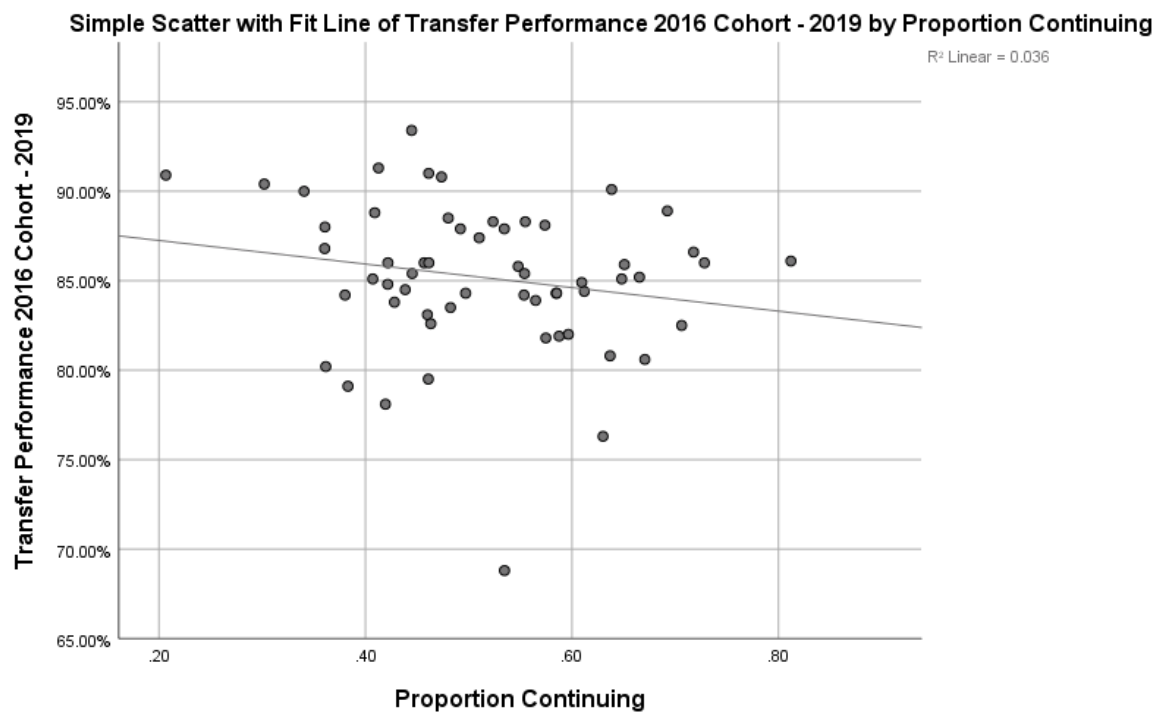
Figure K.6 Proportion of continuing students vs. transfer performance success measure
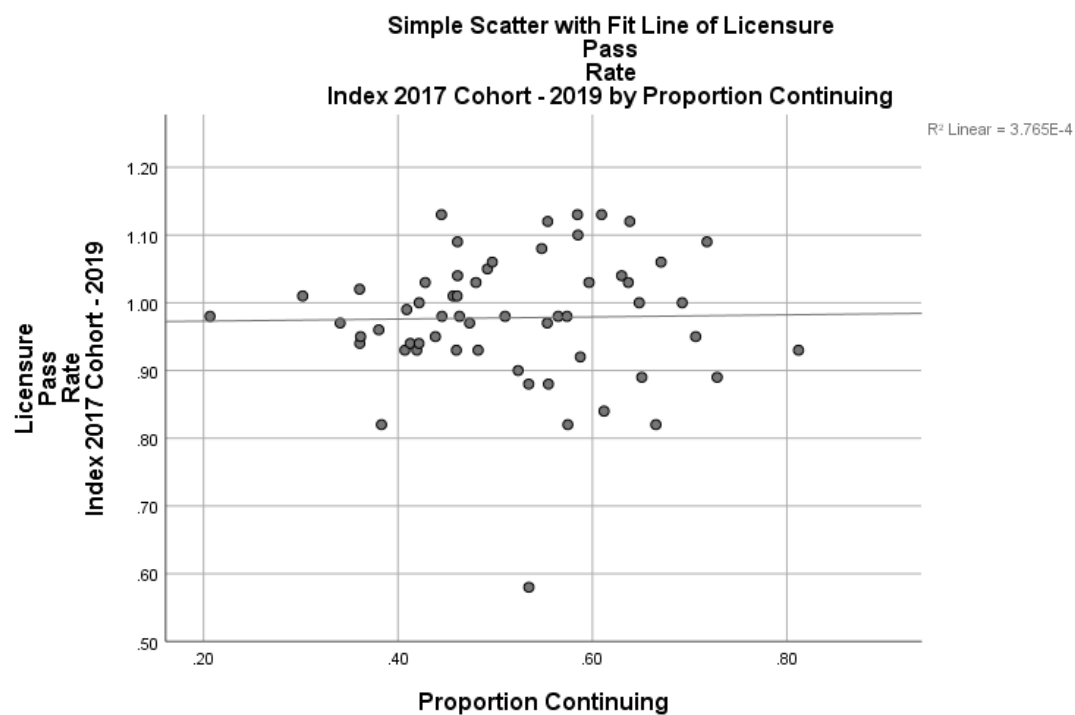
Figure K.7 Proportion of continuing students vs. licensure pass rate performance measure

Appendix L: Scatterplots of Proportion of Non-Degree/Certificate Seeking Students vs.

North Carolina Community College Performance Measures

Figure L.1 Proportion of non-degree/certificate seeking students vs. basic-skills progress performance measure
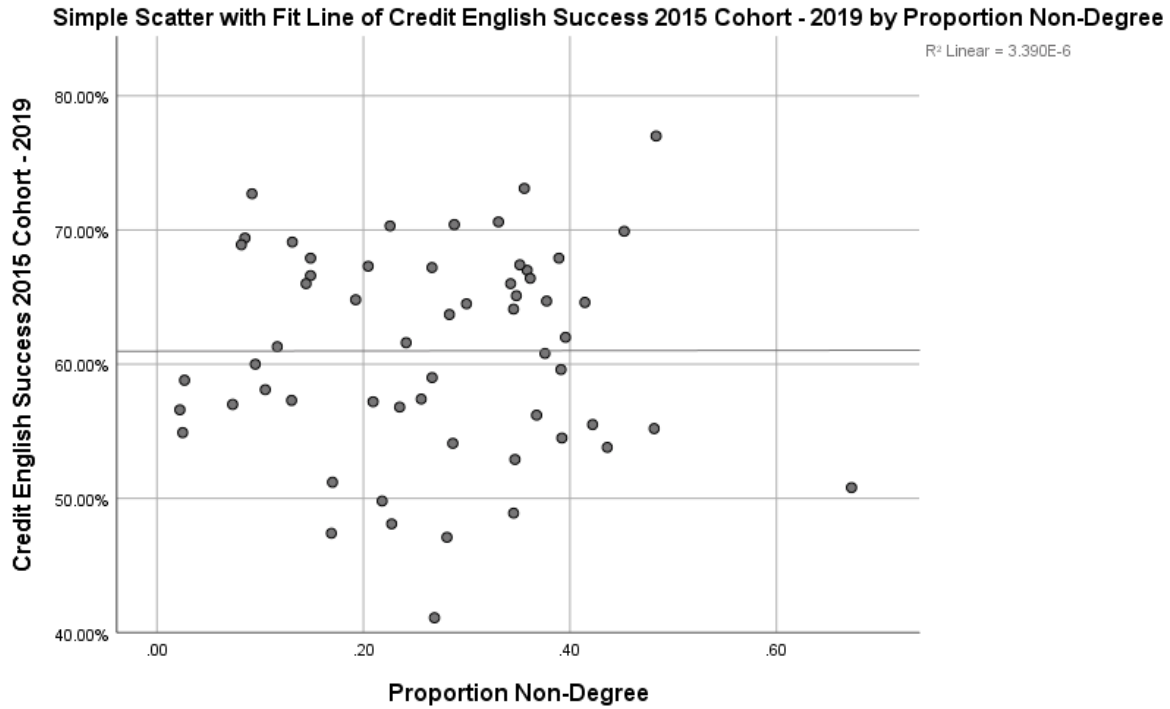
Figure L.2 Proportion of non-degree/certificate seeking vs. credit English success performance measure
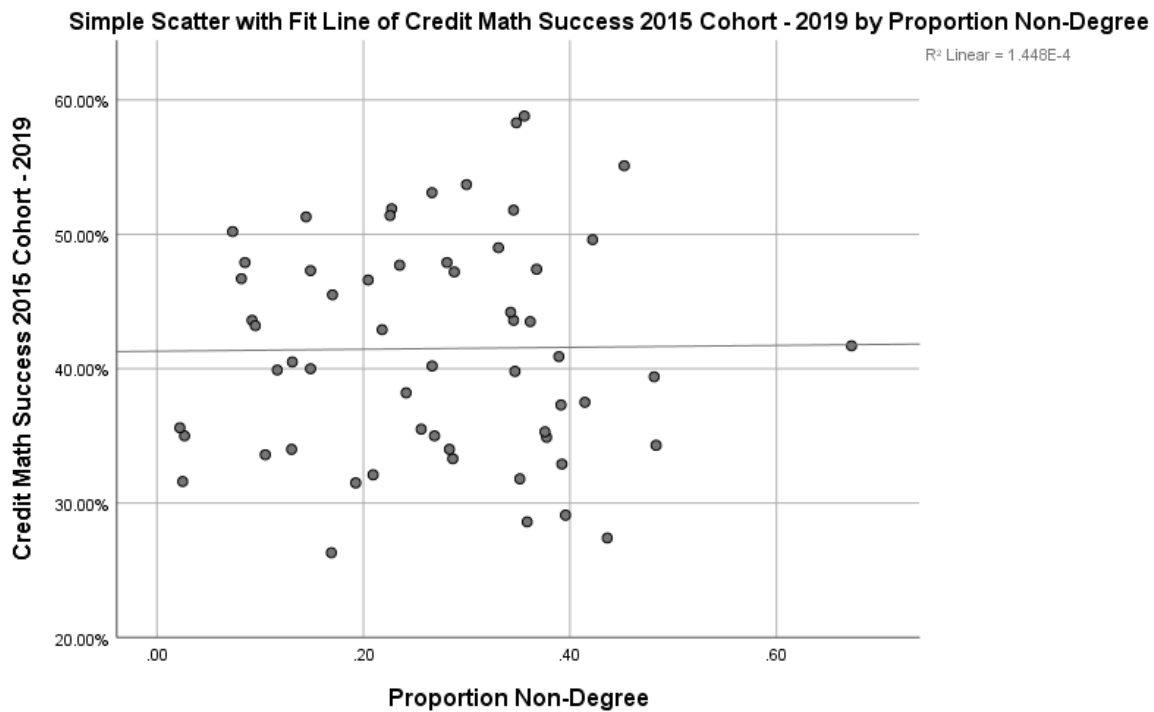
Figure L.3 Proportion of non-degree/certificate seeking students vs. credit Math success performance measure
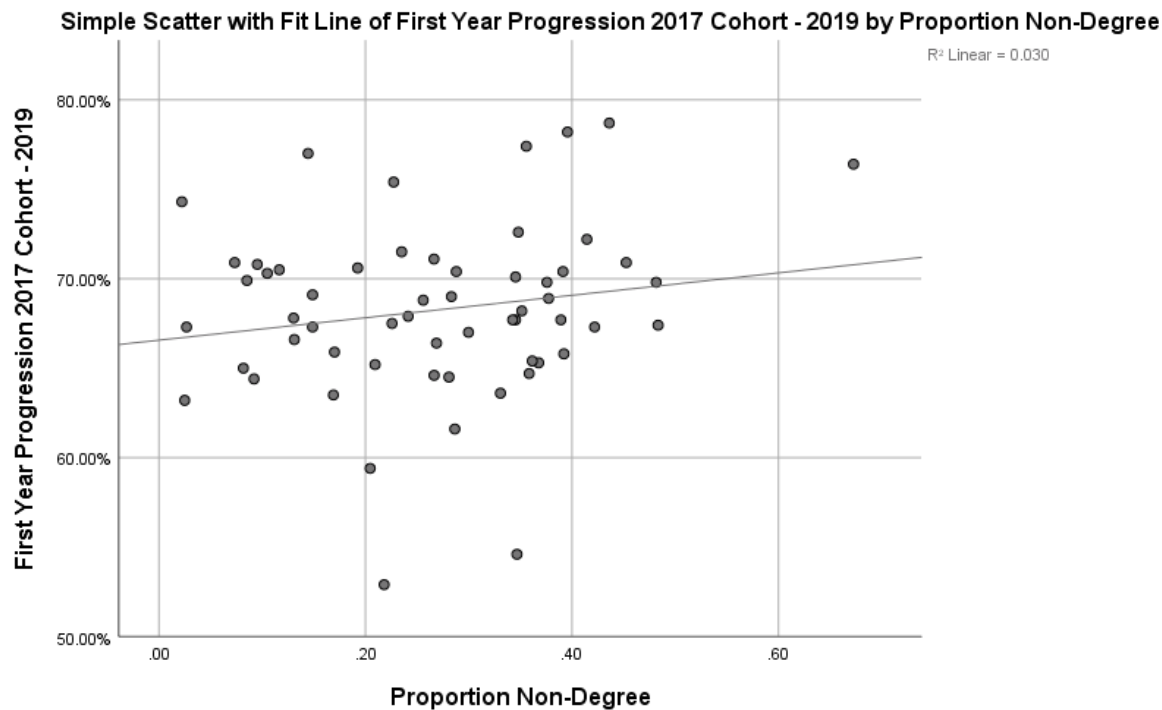
Figure L.4 Proportion of non-degree/certificate seeking students vs. first year progression performance measure
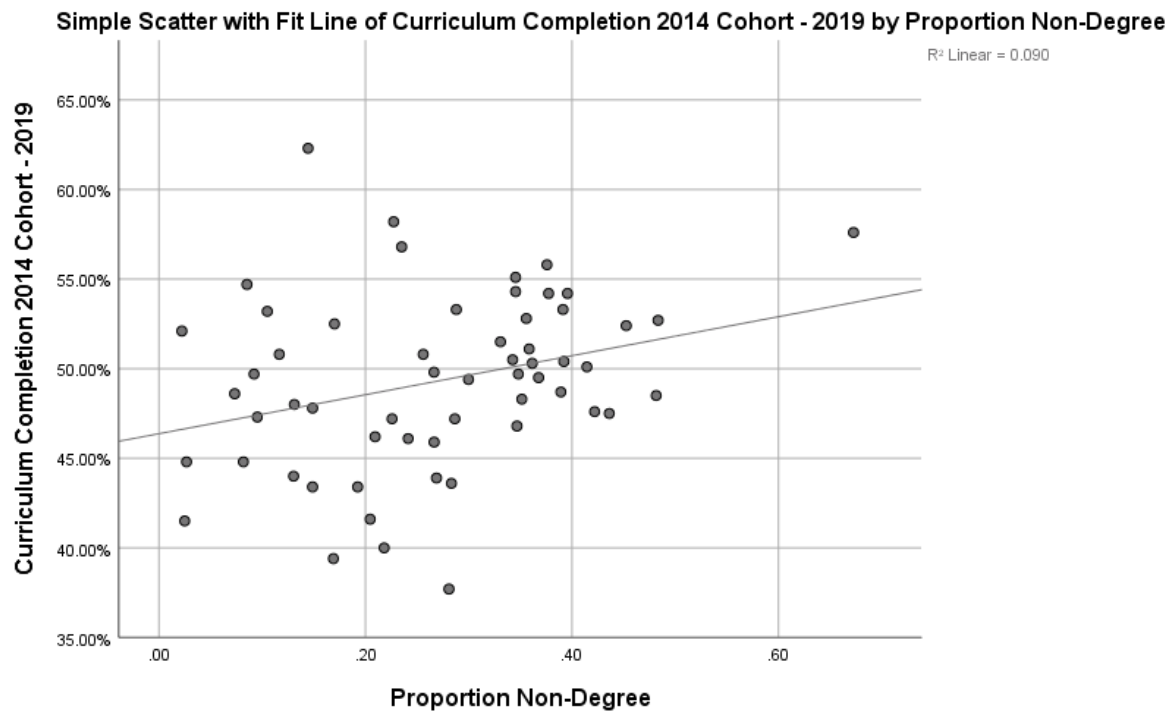
Figure L.5 Proportion of non-degree/certificate seeking students vs. curriculum completion performance measure
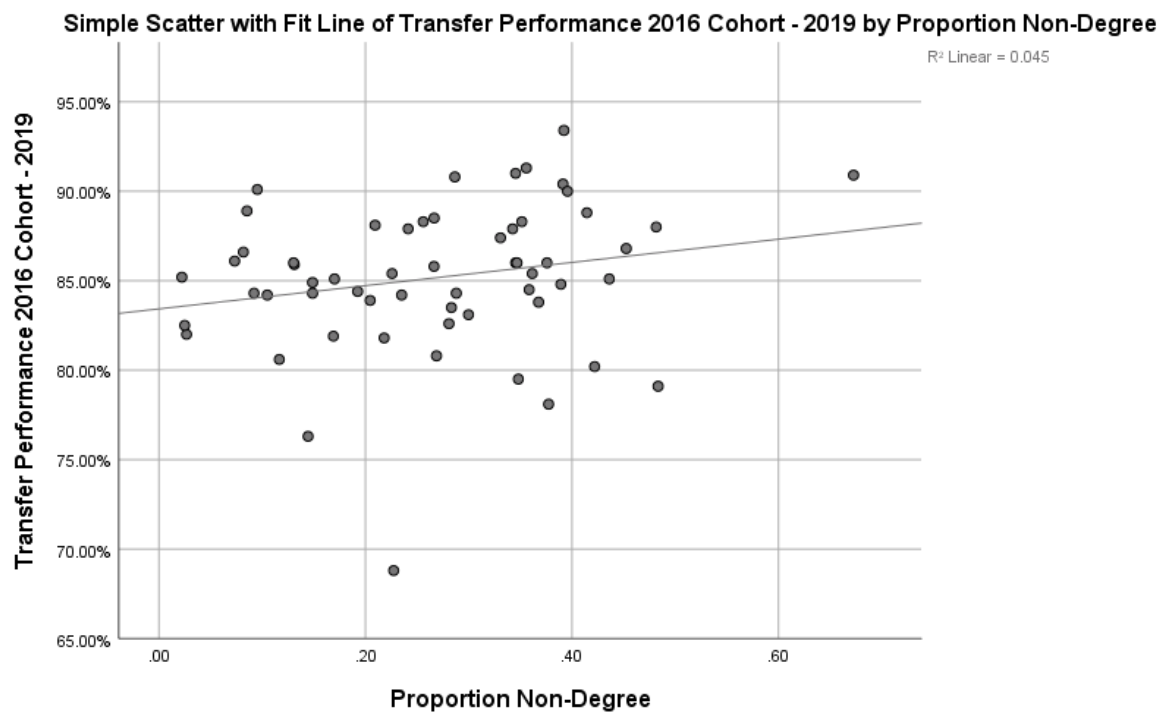
Figure L.6 Proportion of non-degree/certificate seeking students vs. transfer performance success measure
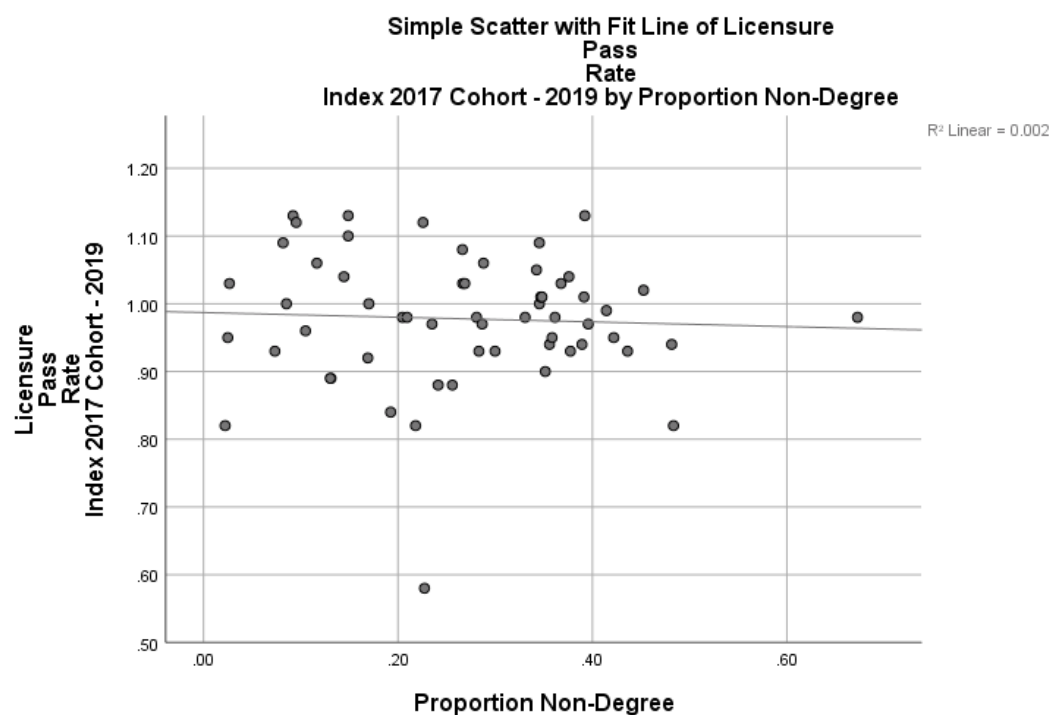
Figure L.7 Proportion of non-degree/certificate seeking students vs. licensure pass rate performance measure

Appendix M: Scatterplots of Proportion of Instructional Staff Classified as Part-Time vs.

North Carolina Community College Performance Measures
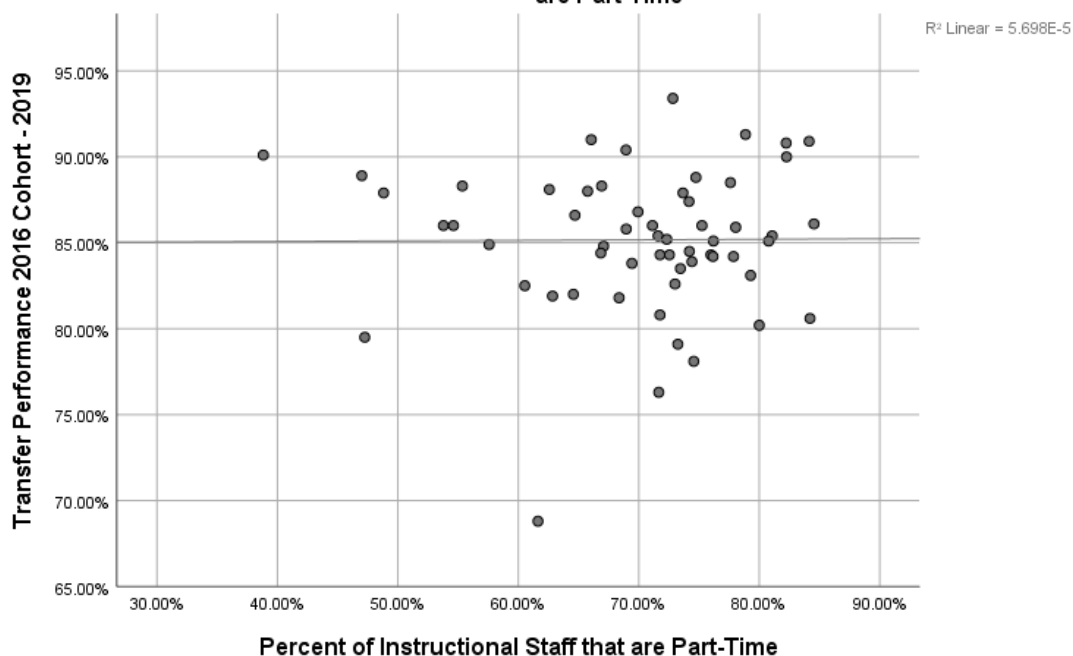

Figure M.1 Proportion of instructional staff classified as part-time vs. basic-skills progress performance measure

Figure M.2 Proportion of instructional staff classified as part-time vs. credit English success performance measure

Figure M.3 Proportion of instructional staff classified as part-time vs. credit Math success performance measure

Figure M.4 Proportion of instructional staff classified as part-time vs. first year progression performance measure

Figure M.5 Proportion of instructional staff classified as part-time vs. curriculum completion performance measure

Figure M.6 Proportion of instructional staff classified as part-time vs. transfer performance success measure

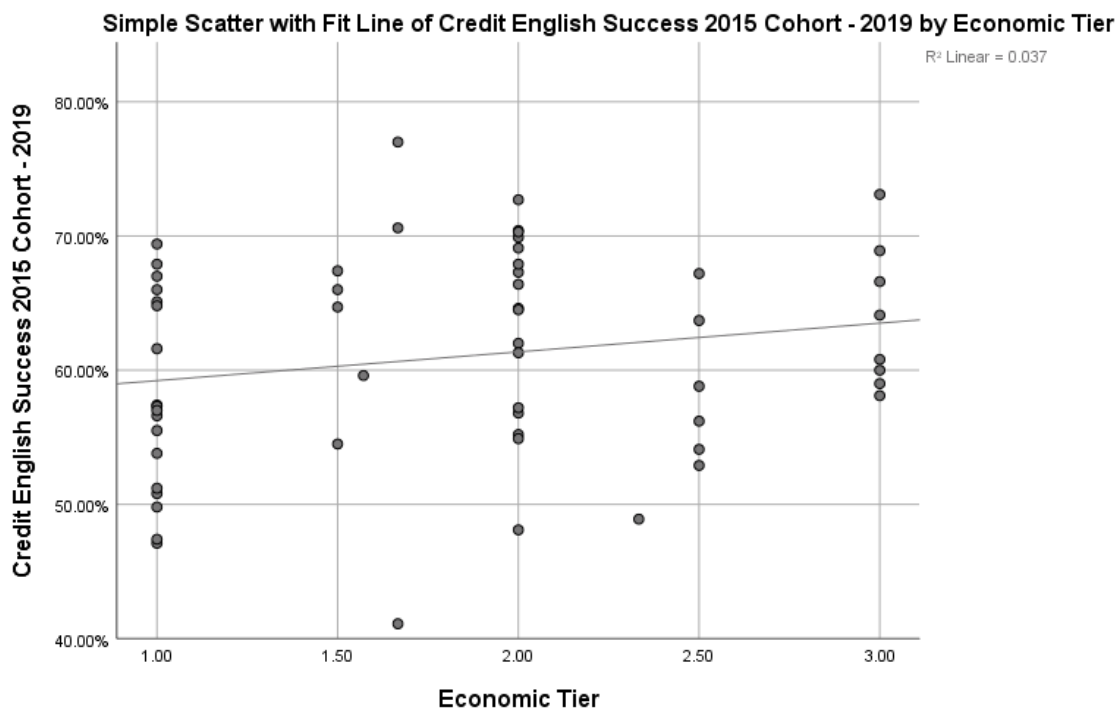*Figure M.7 Proportion of instructional staff classified as part-time vs. licensure pass rate performance measure*

Appendix N: Scatterplots of County Economic Tier vs.

North Carolina Community College Performance Measures

Figure N.1 County economic tier vs. basic-skills progress performance measure

Figure N.2 County economic tier vs. credit English success performance measure
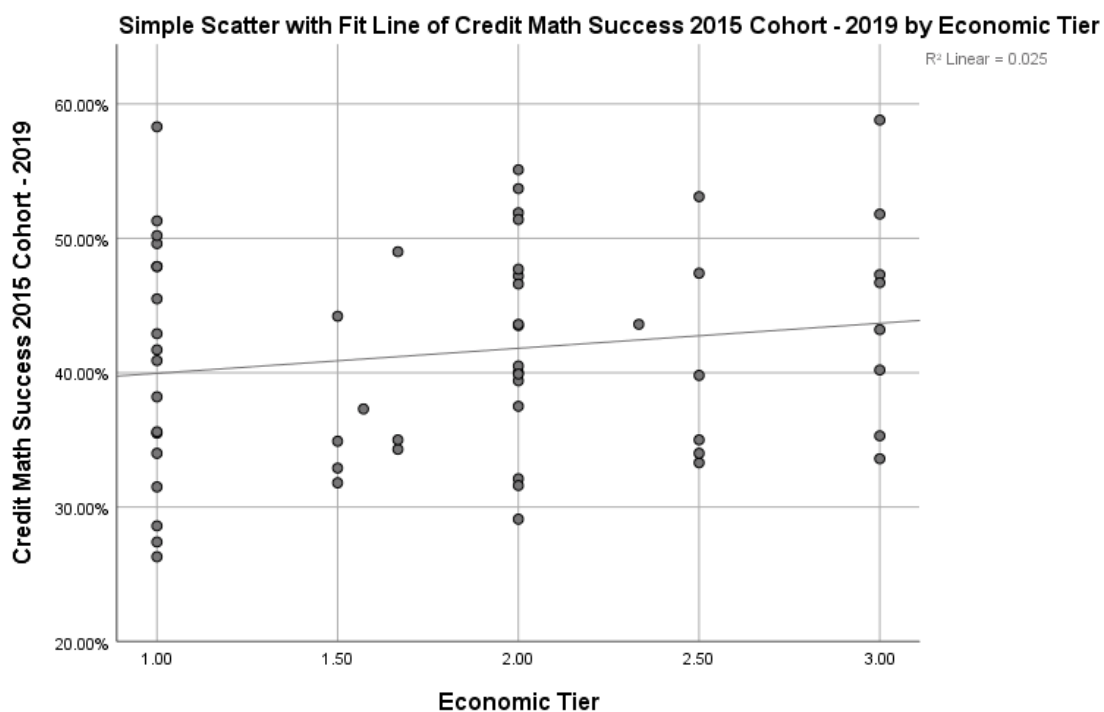
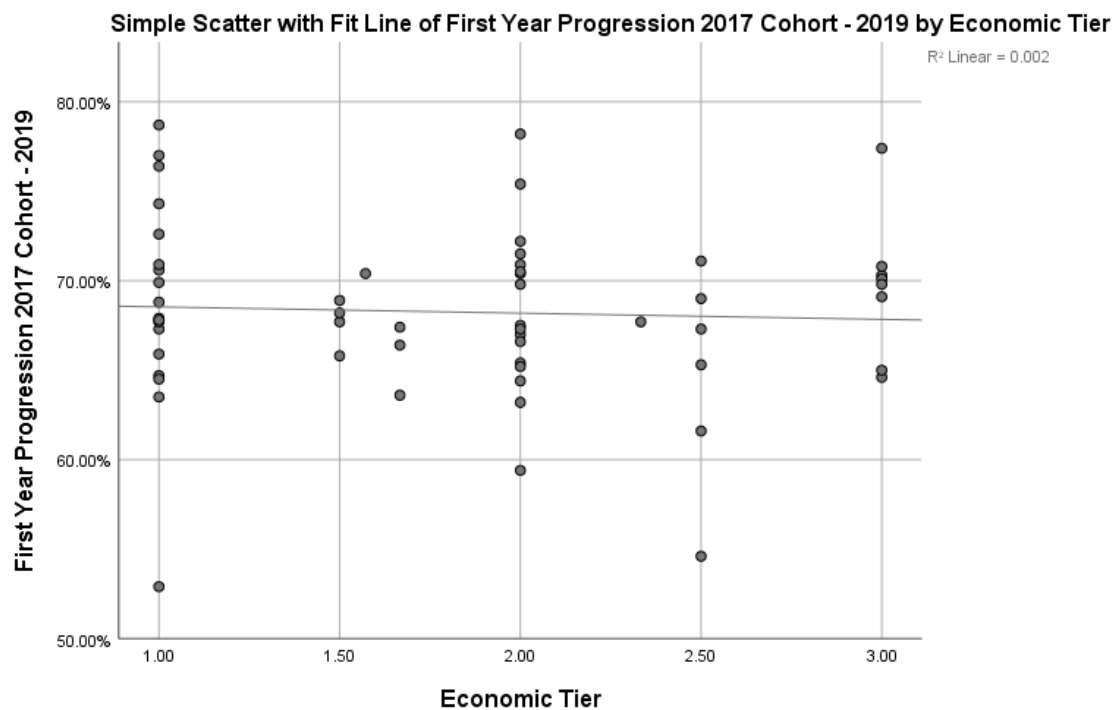*Figure N.3 County economic tier vs. credit Math success performance measure*

Figure N.4 County economic tier vs. first year progression performance measure
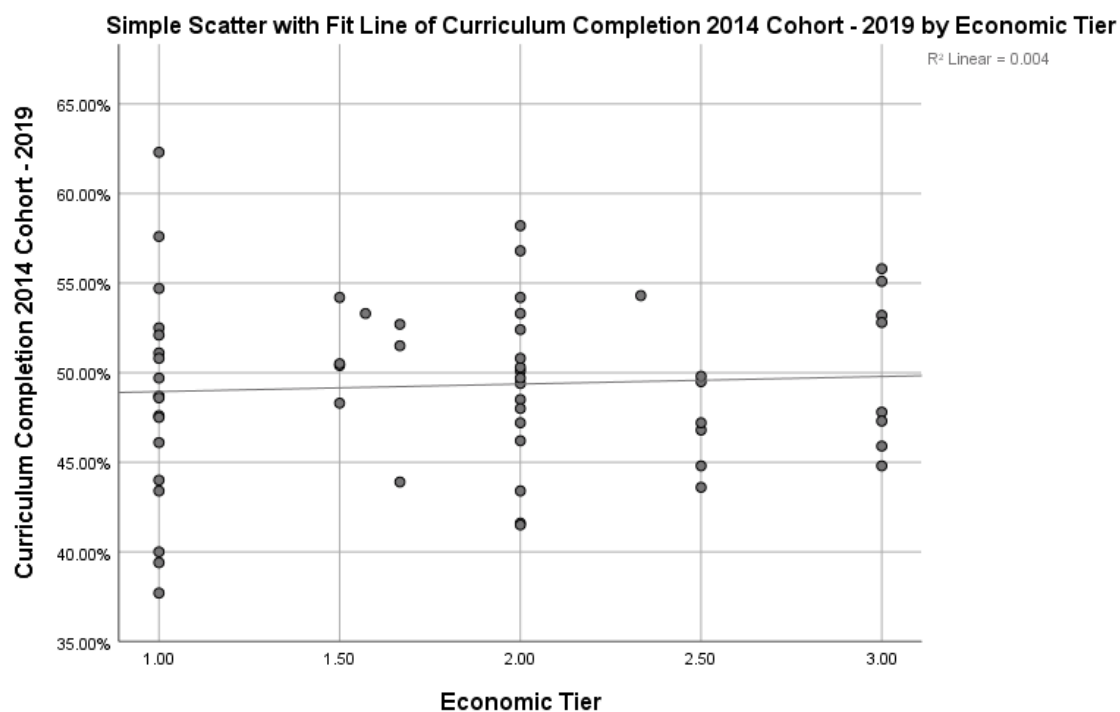

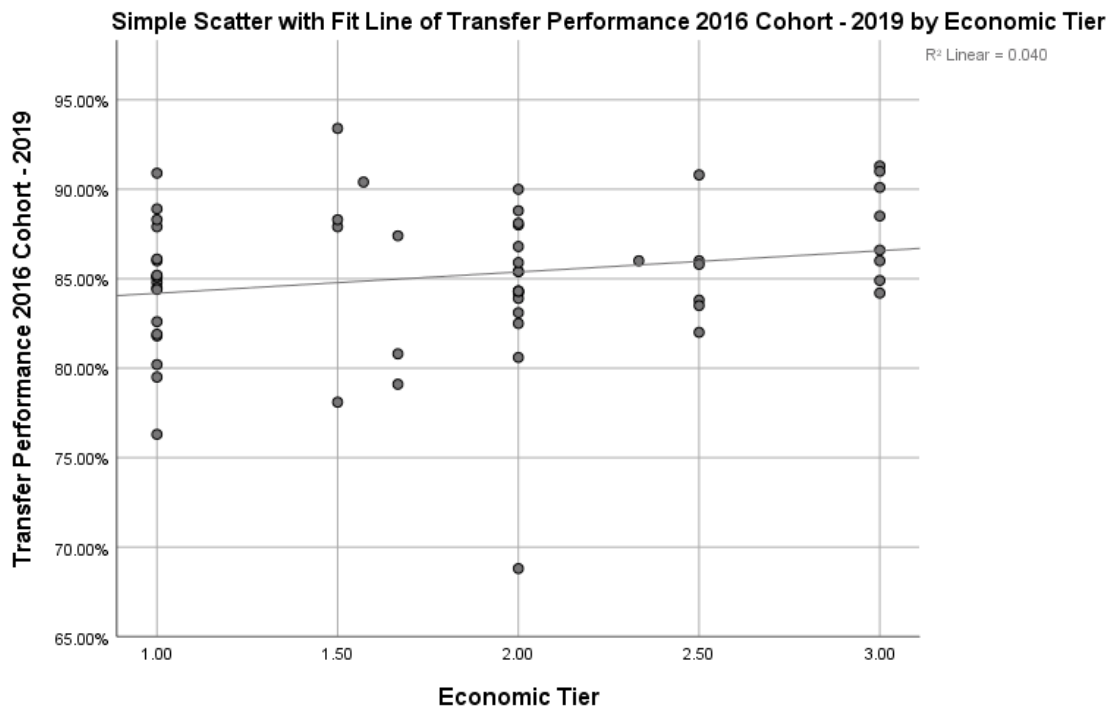*Figure N.5 County economic tier vs. curriculum completion performance measure*

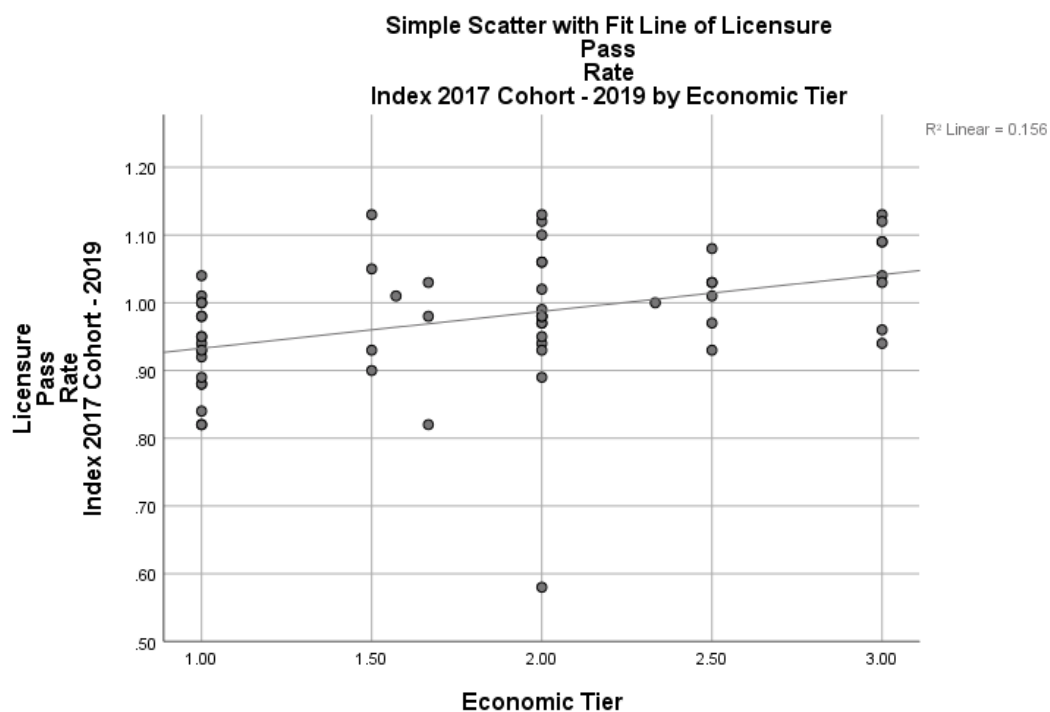*Figure N.6 County economic tier vs. transfer performance success measure*

Figure N.7 County economic tier vs. licensure pass rate performance measure

Appendix O: Licensure and Pass Rate Program Tiers

Tier 1A	Tier 1B	Tier 2	Tier 3
Dental Hygiene	Massage & Body Work Therapist	Basic Law Enforcement Training	Building Inspector
Occupational Therapist Assistant	Veterinary Medicine Technology	Detention Officer	Electrical Inspector
Practical Nursing		AEMT	Fire Inspector
Physical Therapist Assistant		EMR	Mechanical Inspector
Radiography		EMT	Plumbing Inspector
		EMT-P	
		Nurse Aide I	
		Barber	
		Cosmetology	
		Esthetician	
		Manicurist	
		Provisional Real Estate Broker	