NOVA | Northern Virginia Community College

Comparison of STEM and Non-STEM Majors: Fall 2010 Cohort

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Office of Institutional Effectiveness and Student Success Initiatives

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NORTHERN VIRGINIA COMMUNITY COLLEGE

OFFICE OF INSTITUTIONAL EFFECTIVENESS AND STUDENT SUCCESS INITIATIVES

The purpose of the Office of Institutional Effectiveness and Student Success Initiatives is to conduct analytical studies and provide information in support of institutional planning, policy formulation, and decision making. In addition, the office provides leadership and support in research related activities to members of the NOVA community engaged in planning and evaluating the institution's success in accomplishing its mission.

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Table of Contents

List of Tables

List of Figures

Comparison of STEM and Non-STEM Majors: Fall 2010 Cohort

Executive Summary

This report presents data on science, technology, engineering, and mathematics (STEM) majors in comparison to non-STEM majors at Northern Virginia Community College (NOVA). Overall, enrollment in STEM majors has grown eight percent over the past five years. Given the continued growth in STEM enrollment and the high-demand for STEM graduates, it is important to determine whether these students were successful at NOVA. This report presents developmental English placement test results, retention rates, and graduation rates for the Fall 2010 cohort of program-placed first-time in college (FTIC) students to assess whether there were differences between STEM majors and non-STEM majors in these areas (See Appendix for full list of STEM majors offered at NOVA).

A comparison of STEM and non-STEM students' pre-college characteristics suggests differences in the two groups in their academic preparation. Placement test results show that the Fall 2010 cohort of STEM students were less likely to be placed in developmental English courses than non-STEM students. Further, the data indicate that STEM students tended to be more successful in college compared to non-STEM students. Specifically, STEM students were retained at a higher rate and were more likely to graduate within four years.

The data also show that students often changed their academic major across STEM and non-STEM fields during their course of study at NOVA. More of the Fall 2010 cohort who graduated within four years changed their major from a STEM program to a non-STEM program than from a non-STEM program to a STEM program. Of the students who graduated within four years, 39 percent who started in a STEM major switched to a non-STEM major prior to graduation, whereas only nine percent switched from a non-STEM major to a STEM major. Interestingly, students who switched from a STEM major to a non-STEM major had a lower average GPA in their first two semesters than students who remained enrolled in STEM programs. Similarly, students who switched into STEM majors had a higher average GPA than their peers who remained in non-STEM programs.

Students who did not graduate within four years had a lower fall-to-fall retention rate than the overall cohort of Fall 2010 program-placed FTIC students, though again STEM majors who did not graduate had a higher retention rate than non-STEM majors who did not graduate. Students who did not graduate also had a lower average two-semester GPA compared to graduates, regardless of their major field.

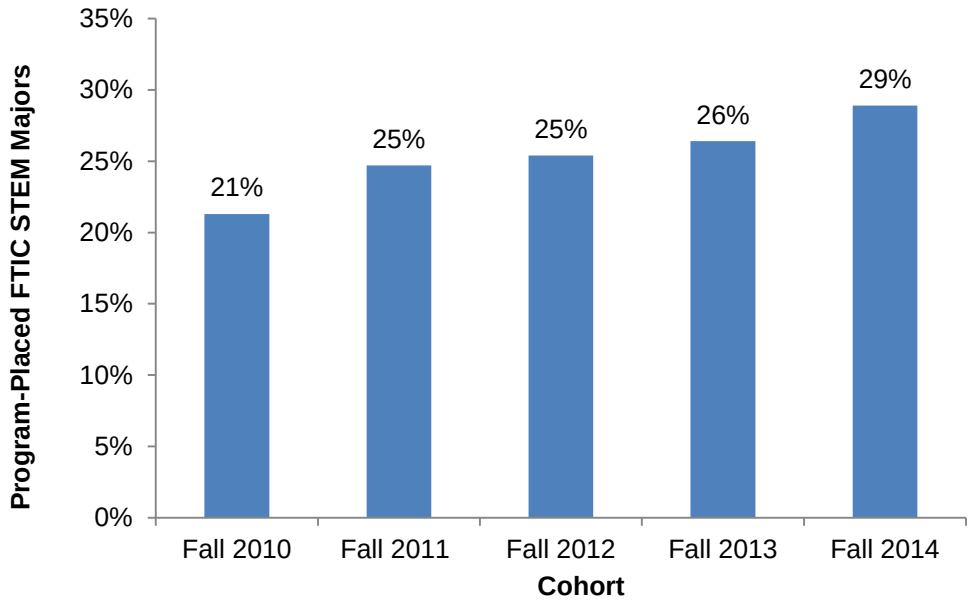
Comparison of STEM and Non-STEM Majors: Fall 2010 Cohort

The proportion of FTIC students at NOVA who were program-placed in their first semester in a STEM program has grown by eight percent in five years, from 21 percent in Fall 2010 (1,352 students) to 29 percent in Fall 2014 (2,236 students) (see Table 1 and Figure 1).

Table 1. Program-Placed First-Time in College Students by Major Field: Fall 2010 through Fall 2014

Degree Field	Fall 2010		Fall 2011		Fall 2012		Fall 2013		Fall 2014	
	#	%	#	%	#	%	#	%	#	%
STEM Majors	1,352	21.3	1,669	24.7	1,833	25.4	2,053	26.4	2,236	28.9
Non-STEM Majors	5,003	78.7	5,097	75.3	5,393	74.6	5,715	73.6	5,493	71.1
Total	**6,355**	**100.0**	**6,766**	**100.0**	**7,226**	**100.0**	**7,768**	**100.0**	**7,729**	**100.0**

Figure 1. Program-Placed First-Time in College STEM Majors: Fall 2010 through Fall 2014



Developmental English Placement

Prior to enrollment, students take an English placement test to determine whether they should be placed in college-level English or developmental English courses[1]. Of students in the Fall 2010 cohort who took both the reading and writing portions of the English placement test, 50 percent of STEM majors (488 students) placed into English 111: College Composition I, an introductory college-level course, compared to 45 percent of non-STEM majors (1,642 students) (see Table 2 and Figure 2, next page).

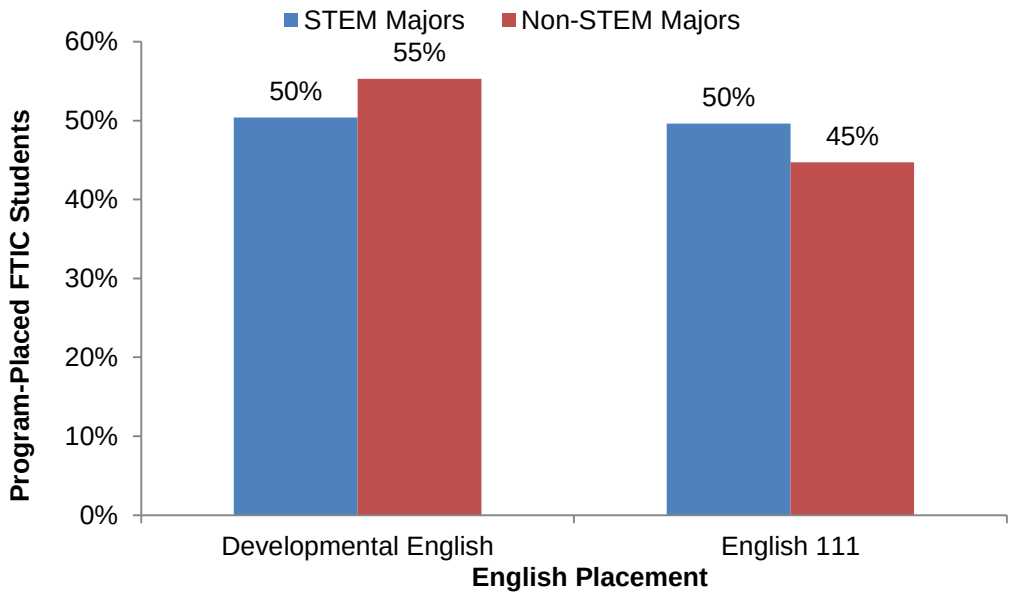
[1] Math placement testing is also required; however math placement testing data were not available at the time of publication.

Table 2. English Placement by Major Field: Fall 2010 Cohort who took Both Portions of Placement Test

Degree Field	Developmental English		English 111		Total Tested
	#	%	#	%	
STEM Majors	495	50.4	488	49.6	983
Non-STEM Majors	2,032	55.3	1,642	44.7	3,674
Total	**2,527**	**54.3**	**2,130**	**45.7**	**4,657**

Note: Placement test scores are not available for 369 STEM majors and 1,329 non-STEM majors.

Figure 2. English Placement by Major Field: Fall 2010 Cohort who took Both Portions of Placement Test



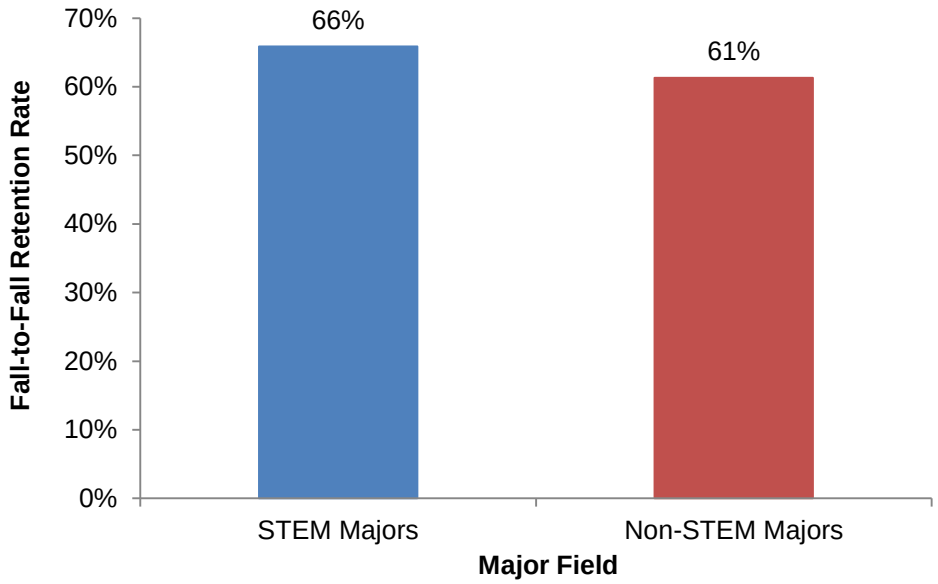
Fall-to-Fall Retention

Fall-to-fall retention, a measure of the percentage of students who return for their second fall semester, is often used to assess student persistence in higher education. Fall 2010 FTIC STEM majors were retained in Fall 2011 at a rate of 66 percent (891 students), compared to 61 percent for non-STEM majors (3,066 students) (see Table 3 and Figure 3, next page).

Table 3. Fall-to-Fall Retention Rates by Major Field: Fall 2010 Cohort

Degree Field	Fall 2010 to Fall 2011 Retention		
	Cohort	Returned	
	N	#	%
STEM Majors	1,352	891	65.9
Non-STEM Majors	5,003	3,066	61.3
Total	**6,355**	**3,957**	**62.3**

Figure 3. Fall-to-Fall Retention Rates by Major Field: Fall 2010 Cohort



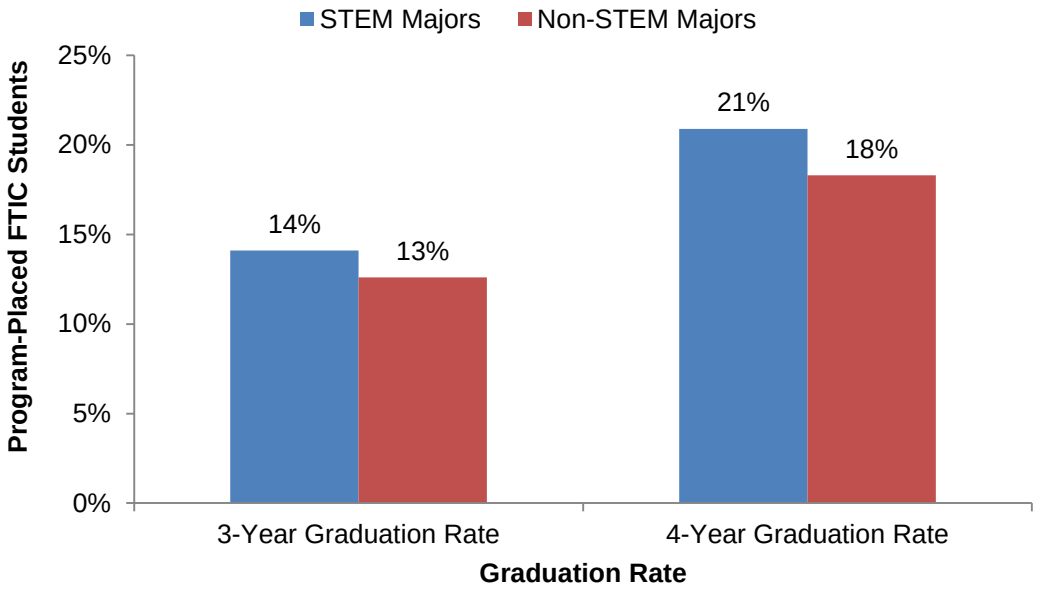
Graduation Rates

As shown in Table 4 and Figure 4 (next page), the three-year graduation rate for Fall 2010 FTIC students in STEM majors was 14 percent (190 students), compared to 13 percent (630 students) for non-STEM majors. The four-year graduation rate was 21 percent (283 students) for STEM majors and 18 percent (915 students) for non-STEM majors.

Table 4. Graduation Rates by Major Field: Fall 2010 Cohort

Degree Field	Cohort	3-Year Graduation Rate		4-Year Graduation Rate	
	N	#	%	#	%
STEM Majors	1,352	190	14.1	283	20.9
Non-STEM Majors	5,003	630	12.6	915	18.3
Total	**6,355**	**820**	**12.9**	**1,198**	**18.9**

Figure 4. Graduation Rates by Major Field: Fall 2010 Cohort



English Placement and Graduation Status

Given that students who major in STEM fields at NOVA tend to be more successful than their peers in non-STEM majors, especially in terms of graduation, it is useful to look more closely at this metric alongside developmental placement, changes in major, and early academic performance.

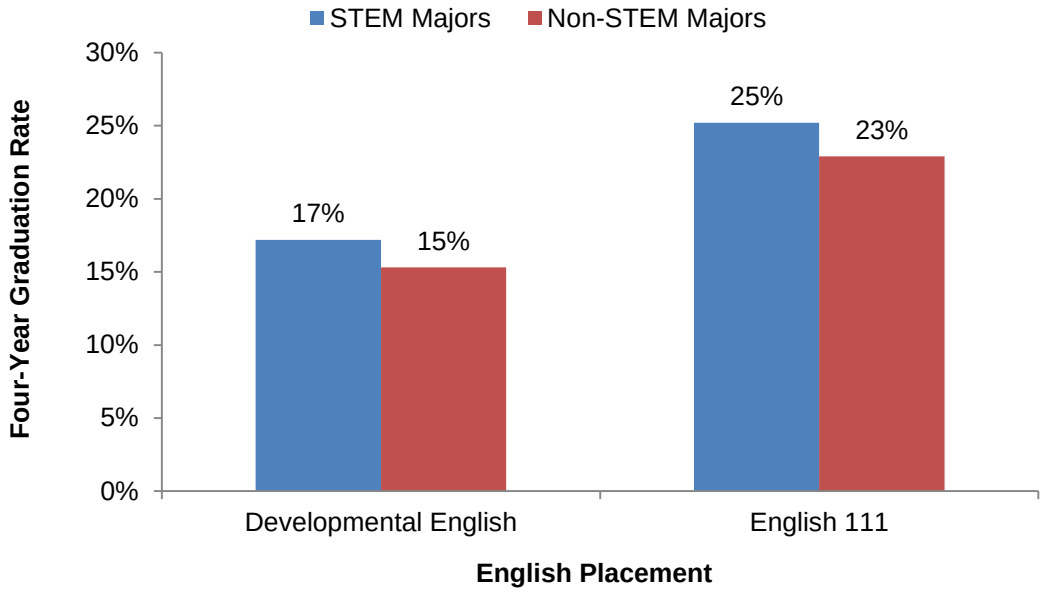
As shown in Table 5 and Figure 5 (next page), STEM majors were more likely to graduate in four years if they placed into English 111 (25 percent, 123 students) compared to developmental English (17 percent, 85 students). Students enrolled in non-STEM majors in their first semester were also more likely to graduate if they placed into English 111 (23 percent, 375 students) compared to developmental English (15 percent, 310 students).

Table 5. Graduation Status by English Placement and Major Field: Fall 2010 Cohort

Graduation Status	STEM Majors				Non-STEM Majors			
	Developmental English		English 111		Developmental English		English 111	
	#	%	#	%	#	%	#	%
Graduated	85	17.2	123	25.2	311	15.3	376	22.9
Did Not Graduate	410	82.8	365	74.8	1,721	84.7	1,266	77.1
Total	**495**	**100.0**	**488**	**100.0**	**2,032**	**100.0**	**1,642**	**100.0**

Note: Placement test scores are not available for 369 STEM majors and 1,329 non-STEM majors.

Figure 5. Graduation Rate by English Placement and Major Field: Fall 2010 Cohort



Changes in Major Field

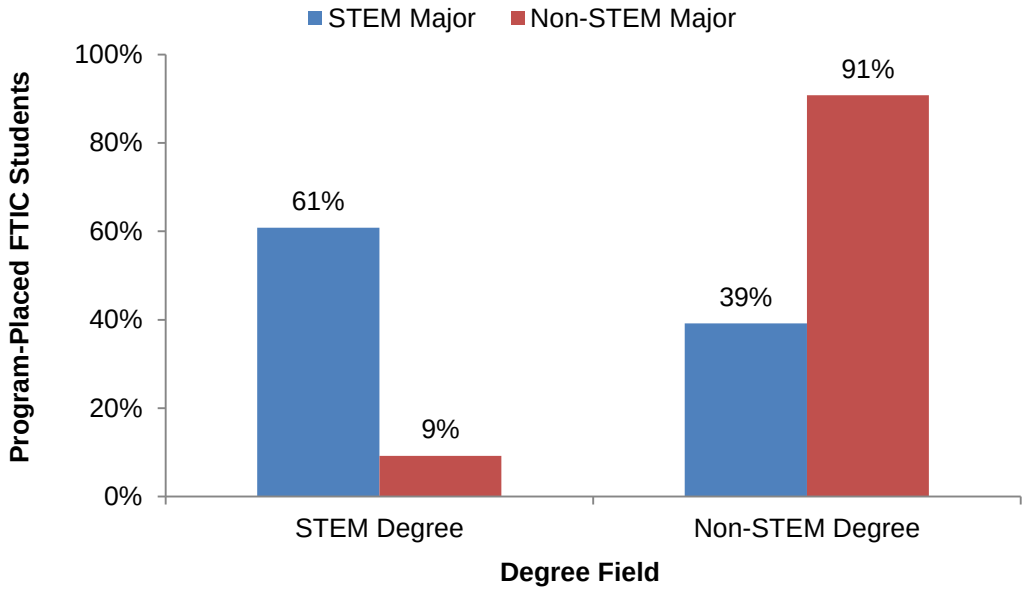
Many NOVA students change their major once or even several times prior to graduation. As the data below show, these changes often involve switching from a STEM field to a non-STEM field, and less frequently, switching into a STEM field from a non-STEM field. One possible explanation for these findings is that students may struggle to succeed in STEM programs compared to non-STEM programs.

Of the 283 FTIC students who were program-placed in a STEM major in their first semester and graduated within four years, 61 percent (172 students) graduated with a degree in a STEM field. The remaining 39 percent (111 students) changed fields and received a degree in a non-STEM field. The majority of students who were enrolled in non-STEM majors in their first semester and who graduated within four years graduated with a non-STEM degree (91 percent, 831 students); 9 percent (84 students) graduated from a STEM program (see Table 6 and Figure 6, next page).

Table 6. Degree Field by Initial Major Field: Fall 2010 Cohort

Degree Field	Initial Major Field			
	STEM Major		Non-STEM Major	
	#	%	#	%
STEM Degree	172	60.8	84	9.2
Non-STEM Degree	111	39.2	831	90.8
Total	**283**	**100.0**	**915**	**100.0**

Figure 6. Degree Field by Initial Major Field: Fall 2010 Cohort



Given that 39 percent of students who initially enrolled in a STEM program and graduated within four years (111 students) switched into a non-STEM program prior to earning their degree, and only a small percentage of students who graduated switched from a non-STEM program into a STEM program (9 percent, 84 students), it is useful to look more closely at these students in order to determine how to help more students succeed in STEM programs. For this purpose, English placement and early academic performance were explored for the two groups of students who switched majors.

English Placement

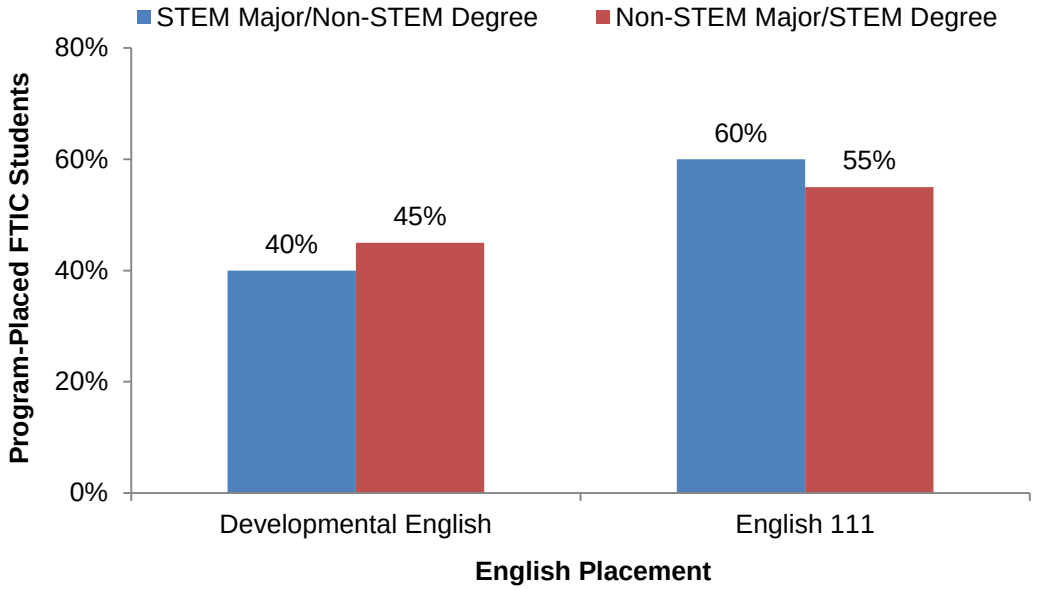
Developmental English placement rates were somewhat lower for students who switched from STEM fields to non-STEM fields than students who switched from non-STEM fields into STEM fields. Of the students who were initially enrolled in a STEM program but eventually graduated from a non-STEM program, 40 percent (37 students) placed into developmental English. For non-STEM majors who switched into a STEM field, 45 percent (28 students) placed into developmental English (see Table 7 and Figure 7, next page). These results are consistent with and are likely an extension of the overall placement results, which indicated that a greater percentage of non-STEM majors are placed into developmental English compared to STEM majors. Developmental English placement may not have a significant bearing on students' major-switching behavior, even though it may have some relevance to the initial choice of STEM or non-STEM majors.

Table 7. English Placement for Graduates who Changed Major Field: Fall 2010 Cohort

English Placement	STEM Major / Non-STEM Degree		Non-STEM Major/STEM Degree	
	#	%	#	%
Developmental English	37	40.2	28	45.2
English 111	55	59.8	34	54.8
Total	**92**	**100.0**	**62**	**100.0**

Note: Placement test scores are not available for 19 STEM majors and 22 non-STEM majors.

Figure 7. English Placement for Graduates who Changed Major Field: Fall 2010 Cohort



Early Academic Performance

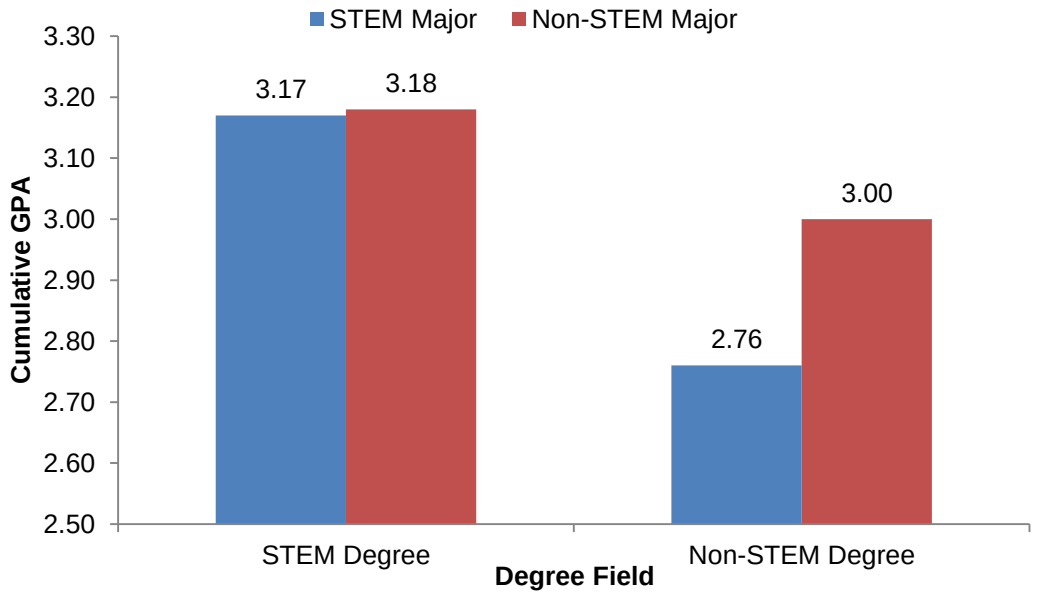
Variations in students' academic performance in their first semesters at NOVA might help explain why some of the Fall 2010 cohort switched between STEM and non-STEM majors. As shown in Table 8 and Figure 8 (next page), students who changed from a STEM major to a non-STEM major had a lower average two-semester cumulative GPA (2.76) than students who remained enrolled in a STEM program (3.17). Students who changed from a non-STEM major into a STEM major had a higher average GPA (3.18) than those who remained in a non-STEM major (3.00).

Table 8. Spring 2011 Average Cumulative GPA for Graduates who Changed Major Field: Fall 2010 Cohort

Degree Field	Average GPA	
	Initial Program of Study	
	STEM Major	Non-STEM Major
STEM Degree	3.17	3.18
Non-STEM Degree	2.76	3.00
Overall	**3.01**	**3.02**

Note: Fall 2010 GPA is included if a student did not enroll in Spring 2011.

Figure 8. Spring 2011 Average Cumulative GPA for Graduates who Changed Major Field: Fall 2010 Cohort



Students Who Did Not Graduate Within Four Years

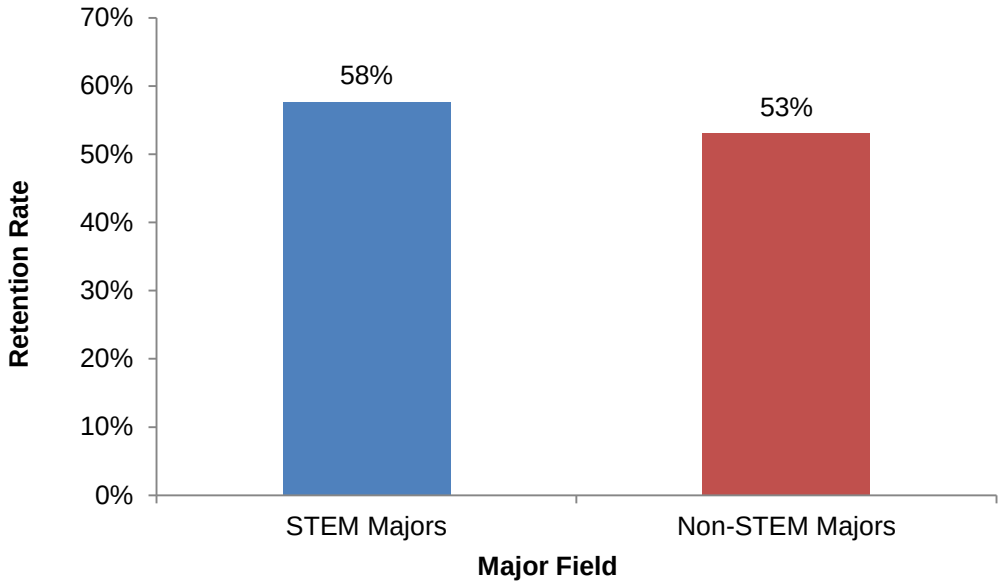
It has been shown that the overall cohort of STEM majors had a higher fall-to-fall retention rate than non-STEM majors. Further, there are differences in the average two-semester cumulative GPA between STEM and non-STEM students. This section of the report focuses on these data for the students in the cohort who did not graduate within four years.

As shown in Table 2 on page 3, the fall-to-fall retention rate for students who did not graduate was lower than that of the overall cohort of program-placed FTIC students in Fall 2010 (54 percent and 62 percent, respectively). As with the overall cohort, STEM majors who did not graduate had a higher retention rate (58 percent, 617 students) compared to non-STEM majors who did not graduate (53 percent, 2,171 students) (see Table 9 and Figure 9, next page).

Table 9. Fall-to-Fall Retention Rates for Non-Graduates by Major Field: Fall 2010 Cohort

Major Field	Fall 2010 to Fall 2011 Retention		
	Cohort	Returned	
	N	#	%
STEM Majors	1,069	617	57.7
Non-STEM Majors	4,088	2,171	53.1
Total	**5,157**	**2,788**	**54.1**

Figure 9. Fall-to-Fall Retention Rates for Non-Graduates by Major Field: Fall 2010 Cohort

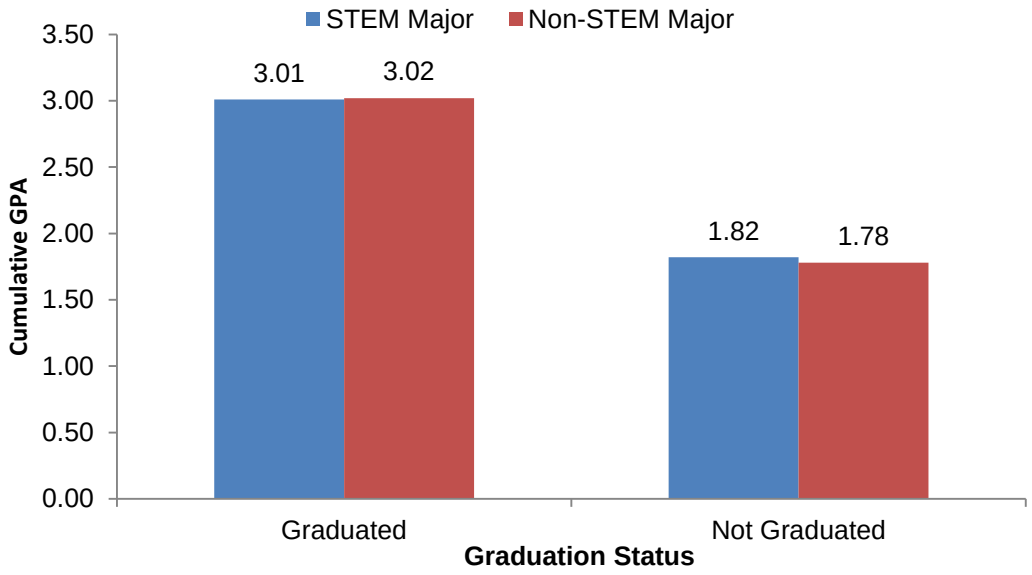


Students who did not graduate also had a lower average two-semester cumulative GPA compared to both the overall cohort and compared to students who graduated within four years. As shown in Table 10 and Figure 10 (next page), students who did not graduate had an average two-semester GPA below 2.0, while graduates averaged over 3.0, regardless of whether they were enrolled in a STEM major.

Table 10. Spring 2011 Average Cumulative GPA by Major Field and Graduation Status: Fall 2010 Cohort

Graduation Status	Average GPA	
	STEM Major	Non-STEM Major
Graduated	3.01	3.02
Did Not Graduate	1.82	1.78
Overall	**2.07**	**2.00**

Figure 10. Spring 2011 Average Cumulative GPA by Major Field and Graduation Status: Fall 2010 Cohort



Conclusion

The data in this report show not only an increase in STEM students at NOVA in recent years, but also that students who select STEM majors are more successful than non-STEM majors in terms of retention and graduation. It is important to note, however, that students who initially select a STEM major are more likely to switch into a non-STEM major than the reverse. Resources such as student support services may help students who initially enroll in a STEM program succeed in that field through graduation. Further, any barriers that make the transition to a STEM program more challenging should be addressed. Given current economic demand, it is likely the percentage of STEM students at NOVA will continue to increase, and it is imperative that these students are able to succeed in their chosen field.

Appendix: STEM Majors at NOVA

Source: State Council of Higher Education for Virginia (SCHEV)

Major	Degree	Major	Degree
Architecture	AAS	Forensic Investigation-Advanced	CSC
Biotechnology	AAS	Forensic Investigation-General	CSC
Computer and Electronics Technology	AAS	Geographic Information Systems	CSC
CyberSecurity	AAS	Health Information Technology	CSC
Dental Hygiene	AAS	Health Science	CSC
Diagnostic Medical Sonography	AAS	IT Technical Support	CSC
Electrical Technology for the Technical Studies	AAS	Land Planning, Survey, and Development	CSC
Emergency Medical Services	AAS	Limited Radiography	CSC
Engineering Technology	AAS	Linux Administration	CSC
Health Information Management	AAS	Linux Programming and Development	CSC
Horticulture Technology	AAS	Magnetic Resonance Imaging	CSC
Information Systems Technology	AAS	Massage Therapy	CSC
Medical Laboratory Technology	AAS	Medical Transcription	CSC
Nursing	AAS	Network Administration	CSC
Occupational Therapy Assistant	AAS	Network Engineering-Professional	CSC
Physical Therapist Assistant	AAS	Network Engineering-Specialist	CSC
Radiography	AAS	Network Security	CSC
Respiratory Therapy	AAS	Optometric Technician	CSC
Veterinary Technology	AAS	Paramedic	CSC
Computer Science	AS	Phlebotomy	CSC
Engineering	AS	Semiconductor Lab Processes Technician-Advanced	CSC
Information Technology	AS	Semiconductor Lab Processes Technician-Operator	CSC
Science	AS	Web Design and Development	CSC
Architectural Drafting	CERT	Web Design Specialist	CSC
Dental Assisting	CERT	Wireless Network Administration	CSC
Electronics Technician	CERT		
Engineering Drafting	CERT		
Substance Abuse Rehabilitation Counselor	CERT		
Surgical Technology	CERT		
Web Design Manager	CERT		
Application Programming	CSC		
Biotechnology Lab Technician	CSC		
Biotechnology Technician	CSC		
Clinical Data Coding	CSC		
Computed Tomography	CSC		
Computer Aided Drafting and Design	CSC		
Database Specialist	CSC		
Desktop Publishing	CSC		
Emergency Medical Technician-Basic	CSC		
Emergency Medical Technician-Intermediate	CSC		

NOVA Mission and Strategic Goals

Mission

With commitment to the values of access, opportunity, student success, and excellence, the mission of Northern Virginia Community College is to deliver world-class in-person and online post-secondary teaching, learning, and workforce development to ensure our region and the Commonwealth of Virginia have an educated population and globally competitive workforce.

Strategic Goals

I. STUDENT SUCCESS – Northern Virginia Community College will move into the top tier of community colleges with respect to the college readiness, developmental course completion, retention, graduation, transfer, and career placement of its students.

II. ACCESS – Northern Virginia Community College will increase the number and diversity of students being served to mirror the population growth of the region.

III. TEACHING AND LEARNING – Northern Virginia Community College will focus on student success by creating an environment of world-class teaching and learning.

IV. EXCELLENCE – Northern Virginia Community College will develop ten focal points of excellence in its educational programs and services that will be benchmarked to the best in the nation and strategic to building the College's overall reputation for quality.

V. LEADERSHIP – Northern Virginia Community College will serve as a catalyst and a leader in developing educational and economic opportunities for all Northern Virginians and in maintaining the quality of life and economic competitiveness of the region.

VI. PARTNERSHIPS – Northern Virginia Community College will develop strategic partnerships to create gateways of opportunity and an integrated educational system for Northern Virginians who are pursuing the American Dream.

VII. RESOURCES – Northern Virginia Community College will increase its annual funding by $100 million and expand its physical facilities by more than one million square feet in new and renovated space. This includes the establishment of two additional campuses at epicenters of the region’s population growth, as well as additional education and training facilities in or near established population centers.

VIII. EMERGENCY PREPAREDNESS AND CONTINUITY OF OPERATIONS – Northern Virginia Community College will be recognized as a leader among institutions of higher education in Virginia for its development and testing of emergency response and continuity of operation plans.

NOVA

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