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Retention and Success of Underrepresented Minorities in STEM at University of Massachusetts Boston: A Pilot Study of the Impact of Freshman Success Communities

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Abstract

Today's college graduates are facing a complex world in which the demand for a sophisticated skill set is ever increasing; this is even more salient in the Science, Technology, Engineering and Mathematics (STEM) fields. Therefore, the success of students majoring in STEM appears critical for meeting the market demand for such degrees. Unfortunately, current rates of success in STEM suggest that there are a number of challenges impeding STEM major completion, particularly for underrepresented minorities. In the academic year 2011, the share of underrepresented minorities (URM) receiving STEM degrees in the University of Massachusetts system was 8.7%. In the 15-campus Massachusetts community college system, this same figure was 12.1%. In Fall 2009, the College of Science and Mathematics at the University of Massachusetts Boston started the Freshman Success Communities program to improve the experience and academic outcomes of its increasingly diverse population. This pilot study is an exploratory investigation of the program's impact, especially on URM. It aims to illuminate the experiences of underrepresented minorities in order to generate insights to support the retention and success of such students. Findings reveal that these learning communities have a positive influence in URM students' performance and academic experience. There appears to be a modest difference in academic achievement between URM and non-URM program participants.

Acknowledgements

This project would not have been possible without the support and collaboration of the College of Science and Mathematics. In particular, we would like to thank Dean Andrew Grosovsky, Associate Dean Marietta Schwartz, Mr. Alexander Gritsinin, Mr. Marshall Milner, and Dr. Joan Becker for their input and feedback in this project. We would also like to thank UMass Boston's Registrar's Office for the data they shared with us and Ebru Korbek-Erdogmus for coordinating our meetings with the College of Science and Mathematics. Finally, we thank all faculty and students who agreed to be interviewed for this pilot study.

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Executive Summary

Science, Technology, Engineering and Mathematics (STEM) fields present substantial opportunities for college graduates. In order for students in STEM fields to reap these benefits, higher education institutions (HEIs) will need to produce a significant number of STEM graduates each year. There are important policy justifications for an increased focus on STEM participation by underrepresented minorities (URM). Unfortunately, there are many challenges to increasing the size and diversity of STEM graduates. A number of interventions have been developed to improve retention and academic success within STEM education. One notable approach is the use of *learning communities*. A body of evidence appears to support the focus on learning communities. This pilot study explores the impact of the learning community model as implemented by the College of Science and Mathematics at University of Massachusetts Boston. Our study complements previous College of Science and Mathematics reports by generating comparisons in participant characteristics and learning outcomes across racial/ethnic groups, and reporting results of interviews with student and faculty program participants. All findings presented in tables and figures are based on administrative data provided by the UMass Boston Registrar's Office.

Key Findings

1. FSC participants have comparable high school preparation, but SAT scores point to a slight disadvantage for URM.

	URM students in FSC	
	# of obs.	Mean
High School GPA	119	3.35
Best SAT Math Score	119	520
	non-URM students in FSC	
High School GPA	233	3.31
Best SAT Math Score	233	571

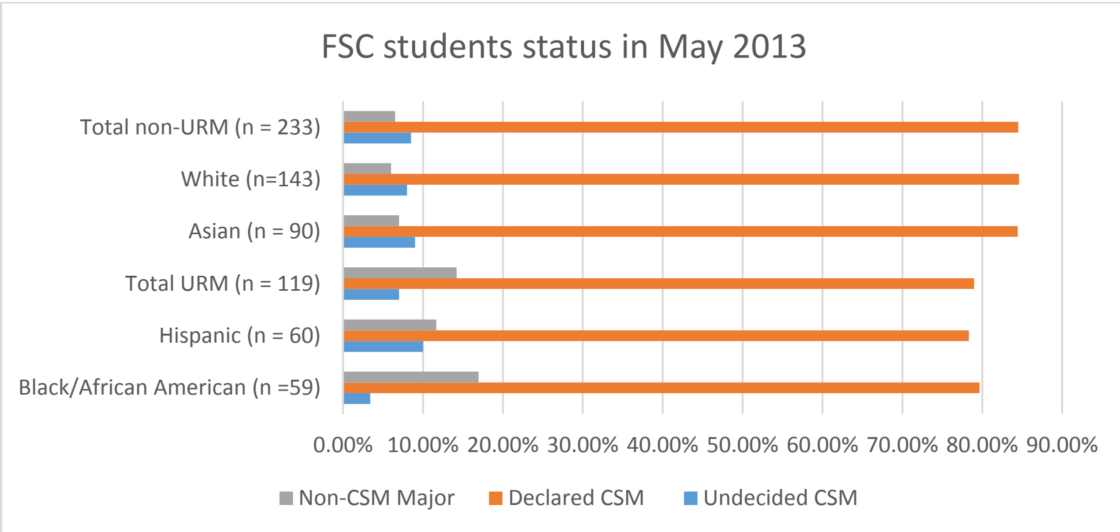
2. FSC participants appear to have better academic success measures than non-participants.

Mean GPA (all academic levels)			
Racial / Ethnic Category	FSC	non- FSC incoming freshman	non-FSC transfer
URM	2.77	2.66	2.20
non-URM	2.98	2.66	2.31

3. We compared GPAs across groups and found a modest difference in performance between underrepresented minorities (URM) in FSC and their non-URM peers.

GPAs of FSC students		
	URM students in FSC	
Race/ethnicity	# of obs.	Mean GPA
Black	59	2.70
Hispanic	60	2.84
URM students	119	2.77
	non-URM students in FSC	
White	143	2.96
Asian	90	3.01
non-URM students	233	2.98
		0.21

4. Some students who have participated in FSC leave the STEM major. Initial analysis indicates that URM are more likely than non-URM to leave the STEM major.



5. FSC have a positive influence on minority students' experiences as STEM majors at UMass Boston. Community building and access to resources seem to be driving the positive student experience and academic performance.

6. Barriers underrepresented minority STEM students face at UMass Boston include: pace of learning, work-school balance, and financial need.

Conclusion & Recommendations

According to the results from this pilot study and the literature, learning communities appear to be a high-impact pedagogical approach. Students and faculty interviewed for this report by and large view FSC positively. Maintaining and improving the quality of the program is likely to contribute to retention and success of STEM students, particularly underrepresented minorities. Based on our findings and the research literature, we make the following recommendations:

- Retain peer mentors, and make sure they understand the catalytic role they play in the retention and success of their fellow STEM students
- Offer physical spaces to learning community participants to solidify their academic collaboration and socialization

- Increase awareness of quality-of-life issues for student participants, including issues outside of UMass Boston
- Track FSC participants who choose non-STEM majors, and gain an understanding of these choices
- Increase hiring of minority faculty in order to boost minority numbers in certain STEM fields (e.g. Environmental Science, Computer Science)
- Find creative ways to expand the program's services to a larger population of students such as : a) incorporating soft skills in introductory courses, b) encouraging former FSC students to mentor non-FSC students

Next steps in this research can include the creation of a longitudinal database with all CSM students, both FSC participants and non-participants. This database could be complemented by an annual survey of graduates (FSC and non-FSC participants). Such tools will greatly improve the monitoring of outcomes provided by the learning communities. While this study was focused on minorities, additional investigation incorporating gender could be useful as well. Furthermore, we are unsure about the extent of collaboration across the various undergraduate level STEM enrichment programs and the FSC program. An important next step in this project is leveraging the combined assets of these programs for the benefit of FSC students.

With STEM playing a vital role in Massachusetts growth strategy, Governor Deval Patrick has welcomed and applauded the UMass system for recognizing the importance of STEM and looks forward to working with the system's leaders to implement a successful program that will ensure that all UMass system's students are prepared for careers in the 21st century global economy (Bay State Banner, 2012). Though designing and implementing the proposed next steps in this work will inevitably require substantial resources, it is likely that the investment will pay off in the form of growth in STEM graduates.

Introduction

Over the past decade, Science, Technology, Engineering, and Mathematics (STEM) jobs have grown at a rate three times faster than non-STEM jobs (USA Today, 2014). As many have reported, careers in STEM present a real opportunity for substantial earnings at the individual level and boosting the national economy (American Council on Education, 2006; Carnevale et al., 2011; Chronicle of Higher Education, 2012). In order to harness opportunities in the STEM fields, higher education institutions (HEIs) will need to produce a significant number of STEM graduates each year, particularly those that are underrepresented minorities (URM). Unfortunately, there are many challenges to doing so. A number of interventions have been developed over the past two decades to boost STEM education. One notable approach is the use of *learning communities*. This approach has been associated with positive outcomes for student participants, especially URM (Zhao and Kuh, 2004; Weaver et al. 2009; Kuh, 2010). The present pilot study was initiated by the Black Faculty and Staff and Students association at UMass Boston to provide a preliminary assessment of the impact of *learning communities* on URM STEM students on campus. We conducted this study through two complementary analyses: (1) analysis of administrative data on students from the College of Science and Mathematics, (2) interviews with URM and faculty who participated in Freshman Success Communities. Findings reveal that these learning communities have a positive influence in URM students' performance and academic experience. URM students who participate in FSC have higher retention rates and GPAs than non-participants. Yet, there appears to be a modest difference in academic achievement between URM and non-URM program participants. The report is organized as follow: I. Institutional Description, II. Background and Motivation, III. Literature Review, IV. Project Description and Research Questions, V. Research Methods, VI. Findings, VII. Research Limitations. The last section of the report provides a conclusion, recommendations, and next steps.

I. Institutional Description

University of Massachusetts Boston (UMB or UMass Boston) is an urban campus, located in Boston, Massachusetts. In Fall 2012, the campus enrolled 15,874 students, 23, 76% of whom were undergraduates. The student body is very diverse: approximately 76% of students are women, with a racial/ethnic makeup of 58% White, 15% African-American, 12% Asian, and

11% Hispanic. 3% are 2 or more “races”, and 1% are Cape Verdean (Office of Institutional Research, 2013). As of Fall 2012, 52% of UMB students are first-generation college students (neither parent graduated from college).

The focus of this report is the College of Science and Mathematics (CSM), one of the University’s 10 colleges and schools. Freshmen comprise two-thirds of CSM’s entering class and that represents a considerable shift from the historic predominance of transfer students in the college (CSM, 2012). With 56% students of color, CSM is the most diverse college at UMB (ibid). As such, CSM can be referred to as a minority serving college within UMB. CSM freshman enrollment has experienced a fourfold increase over the last half-decade (CSM, 2012). The college offers 28 undergraduate programs across six departments: Biology, Chemistry, Computer Science, Mathematics, Physics, and the School of Environment.

In response to the challenges faced by undergraduate students in STEM, especially incoming freshmen, Freshman Success Communities (FSC) were developed by Dean Andrew Grosovsky (UMass Boston, 2011, College of Science and Mathematics, 2012). The program started in the Fall 2009 with 46 students and has since grown to over 200 students during the 2012-2013 academic year, and over 500 since its inception (Grosovky et al., 2014).

II. Background and Motivation

Today’s college graduates are facing a complex world in which the demand for critical skills is ever increasing; such an observation is even more salient in the so called Science, Technology, Engineering and Mathematics (STEM) fields. As has been noted by other researchers, in order to stay competitive on a global scale, America needs to diversify and increase its pool of STEM professionals (Center on Education and Work, 2008; Fearweather, 2010; Hurtado et al., 2010; Chronicle of Higher Education, 2012). However, retention rates in STEM are dismal: fewer than 40 percent of students who enter college intending to major in a STEM field actually complete a STEM degree (President’s Council of Advisors on Science and Technology (PCAST), 2012 as cited in Villareal, Cabrera, and Friedrich, 2012). Blacks and Hispanics are particularly underrepresented in relation to their proportion to total population (Palmer et al. 2011). Among students who entered college as a STEM major 23% of Black and

30% of Latino students earned a bachelor's degree, while 35% Whites and 40% Asians did (Higher Education Research Institute, 2010).

Moreover, the American higher education system has experienced some dramatic demographic changes in the past few decades, with minorities quickly becoming a much larger share of student enrollment; according to Eugene Anderson, "higher education will continue to become more racially diverse because the rate of growth among people of color in the United States is significantly higher than for whites" (Anderson, 2003). One way to meet the global competitiveness challenge is to significantly improve completion of STEM degrees by underrepresented minorities. President Caret's recent announcement of "ABLE 4 STEM" – which aims to double the number of URM STEM Degree completion – underscores the importance of this issue (University of Massachusetts System, 2012).

Nationally, only about 29% of underrepresented minorities entering STEM majors graduate compared to 40% of all entering STEM majors (Hayes, 2007 as cited in Center for Education and Work, 2006). In academic year 2011, the share of URM STEM degrees in the UMass System was 8.7% and 12.1% in the 15 Massachusetts community colleges (University of Massachusetts System, 2012). The University of Massachusetts system's numbers are significantly lower than the already alarming national percentages. As acknowledged by Dean Grosovsky, graduating a diverse STEM class each year at UMass Boston remains a work-in-progress (Cooper, 2014). Such numbers, the commitment of university to address the issue through involvement in various initiatives aiming to directly or indirectly influence minorities' success in STEM, and the launching of ABLE 4 STEM all contributed to the timeliness of this research project.

An initiative of the Black Faculty and Staff and Students association (BFS&S) at UMass Boston, this pilot study aims to contribute to the broader understanding of the role of learning communities in retention and success of URM in STEM, with a particular emphasis on UMass Boston, a diverse campus. BFS&S members Michael Johnson and Liliana Mickle and Public Policy PhD student Alvine Sangang came together in the Fall of 2012 to devise a project that could serve the minority community on campus. The unveiling of the STEM initiative by President Caret (Bay State Banner, 2012) steered us towards looking at how the college could help its URM STEM students. Early review of literature on learning communities showed them to be a promising intervention in STEM education, particularly for minorities. Hence, we decided to focus our project on Freshman Success Communities at UMass Boston.

III. Literature Review

Among several others, the learning community pedagogy has emerged as a popular intervention to improve student retention and success in STEM. A *learning community* can be defined as a formal program where groups of students take two or more classes together, and may or may not have a residential component (Zhao and Kuh, 2004). Learning communities enroll a group of students in the same classes so they will get to know each other quickly, enabling them to work together and have a social circle from the onset of their academic journey. Although various adaptations of this concept have been implemented by HEIs, learning communities share some defining characteristics: shared knowledge, shared knowing, and shared responsibility (Tinto, 2003). *Shared knowledge* refers to the fact that students are taking the courses around a common theme, *shared knowing* refers to the camaraderie that develops among participants, and *shared responsibility* refers to the mutual dependence on which the students tend to rely to make progress academically.

Studies on learning communities have overwhelmingly revealed a positive influence on students' retention and success in STEM majors (Zhao and Kuh, 2004. Price, 2005; Andrade, 2007; Weaver et al. 2009; Kuh, 2010). Participants of such communities show higher retention and better performance, relative to their counterparts who are not in learning communities. In what is perhaps the most comprehensive study on the outcomes of LCs, Zhao and Kuh (2004) analyzed data from the National Survey of Student Engagement (NSSE), an annual survey of first-year and senior college students. The sample was comprised of 80,479 randomly selected first-year and senior students from 365 four-year colleges and universities who completed the survey in 2002 (Zhao and Kuh, 2004). The findings point to a uniformly positive link between LCs and student success outcomes including enhanced academic performance, integration of academic and social experiences, positive perceptions of the college environment, and self-reported gains since starting college (Zhao and Kuh, 2004). LCs allow students to create their own supportive peer groups that extend beyond the classroom; they become more involved and dedicate more time and effort to academic activities instead of being a passive receiver of information (Zhao and Kuh, 2004).

Nevertheless, as Tinto (2003) notes, LCs are by no means a “magic bullet” to student learning. Some faculty and students may not be as enthusiastic about the type of collaborative environment that LCs require. That is precisely why some additional approaches to retention and success in STEM exist. One such approach is Supplemental Instruction (SI). Supplemental instruction consists of small study groups led by junior or senior students for high risk introductory courses. Research on SI programs show that students accrue substantial benefits from them. For example, Peterfreund et al. (2006) found that at San Francisco State University, SI appeared responsible for enabling many more students to pass the courses and complete bachelor’s degrees than would be possible without the program. GPAs of students who participated in SI for introductory courses such as Intro Biology, Genetics, Organic Chemistry and Calculus were higher than those of the non-participants.

Some other promising programs, with an emphasis on mentoring and advocacy, have been specifically designed for minorities; these include the University Leadership Network (ULN) at the University of Texas at Austin (Tough, 2014). This program targets students who are considered to be “at risk”, i.e. those who hail from low income families and are typically first-generation college students. The ULN provides students with leadership skills necessary to achieve academic success and graduate in four years. Participants also receive professional development training and engage in community service. Another highly effective intervention is the Meyerhoff Scholars Program at University of Maryland Baltimore County (UMBC). It has exposed young minority students to interesting mathematics- and science-related research for many years (Hrabowski, 2001), and is responsible for making UMBC the leading predominantly White baccalaureate origin institution for African-American STEM PhDs in the US (Maton and Hrabowski, 2004; as cited in Pearson and Leggon, 2004).

Learning communities and the aforementioned alternative interventions in STEM education all aim to tackle the challenge of expanding and diversifying the STEM pipeline. However, they are all focused on the student within its academic context. While relationships with peers and an enabling academic environment are important for STEM, psychology research points to the much less studied contribution of support networks outside of the school environments. According to Syed et al (2011) students with integrated support across multiple domains (i.e., peers, families, and teachers) have better mental health than those who have high friend support but are lacking family support.

Indeed, many strategies have been identified in order to facilitate and ensure student success in STEM. *Learning communities*, however, have enjoyed a particular attention. Cross (1998) and Zhao and Kuh (2004) attribute this to the positive outcomes and experiences they yield for participants.

IV. Project Description and Research Questions

The purpose of this pilot study was to explore how the College of Science and Mathematics' Freshman Success Communities (FSC) have contributed to URM STEM majors' retention and success at the University of Massachusetts-Boston. We achieve this goal by addressing the following questions:

1. What initial barriers to success in STEM majors are faced by minority students with freshman standing? Are they unique or distinctive from other students?
2. What internal characteristics and external factors of FSC are associated with improved educational outcomes?
3. What are the characteristics of FSC participants who persist in CSM's course of study?
4. Have CSM's Freshman Success Communities reduced the achievement gap between minority and non-minority students?
5. What aspects of learning communities have been adapted by CSM's FSC initiative?
6. In what ways are FSC distinct from other UMass Boston student enrichment programs?
7. What other innovations from learning communities literature could enhance the impact of CSM's FSC model?

V. Research Methods

This study utilized a convergent mixed methods design as described in Creswell (2014). This approach seeks "convergence, corroboration, and correspondence of results from [qualitative and quantitative] methods" (Creswell, 2014). Thus, we collected the qualitative and quantitative data concurrently. Mixed Methods were appropriate for this project because they enable the researcher to take advantages of the complementarities of quantitative and qualitative methods. Quantitative methods in this project allowed us to analyze key student outcomes such as GPAs and cumulative credits. Qualitative methods, on the other hand, helped us unpack the FSC student experience through in depth interviews. In October 2013, we received approval from the Institutional Review Board at UMass Boston to conduct this pilot study. This section describes the data used and the analysis procedures.

Data Description

Quantitative data

We collected the FSC participant data from CSM Associate Dean Marietta Schwartz. With permission from the Office of Diversity and Inclusion, we collected additional student data from UMass Boston's Registrar's Office. The Registrar's Office provided three data sets: one including students who have participated in Freshman Success Communities (FSC), one including students in CSM who came in as transfer students, and one including all CSM students who came in as incoming freshmen. Each of the datasets included the following variables: admission term, student major, academic level, cumulative credits, cumulative GPA, ethnicity/race, high school attended, high school GPA, SAT scores, and transfer credits for transfer students.

In order to analyze the data provided, we made some alterations to the datasets. First, because part of our analysis focuses on racial gaps, all students with "not specified" racial categories were deleted from all three data samples. Second, the data analyzed only considered the best Math SAT scores of the students included in the study; hence, scores from other portions of the test were excluded from analysis. Third, we created a non-FSC students sample for comparison purposes.

Qualitative data

We conducted four interviews with professors who have taught the FSC gateway seminar. Six interviews were conducted with students who have participated in FSC. The interviews ranged from 20 to 60 minutes. We recruited faculty with the help of the CSM, particularly the Dean. We recruited students through phone calls. We invited faculty to the study via emails from a list of all FSC instructors provided by CSM. We conducted all faculty interviews between May and August 2013. We recruited students randomly from a stratified sample of FSC participants. Five student interviews were conducted between August 2013-November 2013 and one in March 2014. A summary of respondents' backgrounds is provided in Table 3 in Section VI. For more details on the project timeline, see Appendix 2.

Data Analysis

Quantitative data

We used Microsoft Excel and STATA 12 to analyze the administrative data. We received the data in Excel format and subsequently converted in CSV format in order to enter them into STATA. We generated all tabulations and descriptive statistics from STATA. Once all the analysis was complete in STATA, we transferred results to Excel for a cleaner output and creation of supporting visuals from the analysis. Given the limited resources and the exploratory nature of this project, we only performed descriptive point-in-time statistical analysis with the quantitative datasets acquired. A longitudinal and multivariate exploratory analysis, though of clear policy interest, will have to await further studies.

Qualitative data

All qualitative research techniques used in this project are discussed in Weiss (1994), Maxwell (2013), and Rossman and Rallis (2011). We recorded all interviews and transcribed the audio files. Because of the limited amount of time, the audio files were not transcribed verbatim; still, they captured all of the depth of respondents' answers for the purpose of this report. From these transcriptions, we created an analysis grid in Word with the relevant themes from the study. We utilized open coding techniques (Rossman and Rallis, 2011; Maxwell, 2013) and issue-focused analysis (Weiss, 1994), with a pre-determined framework based on the interview questions. This means that while specific themes were identified prior analysis, we still read the transcripts for emerging themes not previously considered. We used color-coding to identify themes throughout the transcripts and integrated text from the transcripts into the analysis grid after several readings of the transcripts. Finally, we created the analysis narrative with key points made by respondents and supporting quotes.

VI. Findings

In this section, we report findings from the pilot study. First, we present some descriptive analyses based on the quantitative data. Then, we present the qualitative findings. Finally, we discuss our findings.

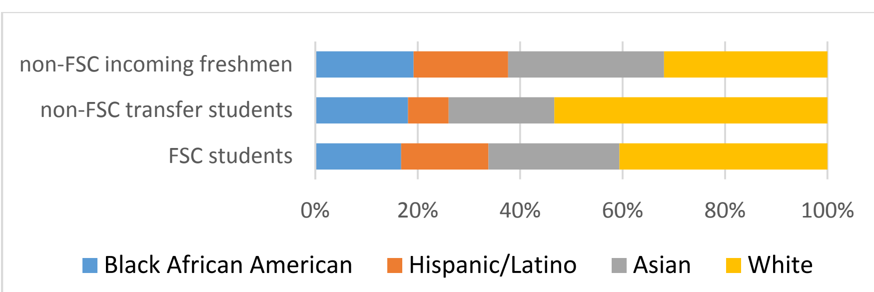
Quantitative Findings

Table 1, below, contains a distribution of students in the three data sets by race and ethnicity. Students classified as “unknown” or “not specified”, or “two or more races” were deleted from all data sets[1]. Figure 1 below provides a chart of the distributions. These data show the distribution of students in FSC more or less mirrors the distribution of non-FSC incoming freshmen. However, white students seem to be slightly overrepresented in FSC.

Table 1: Distribution of students in the datasets by race and ethnicity

Race/Ethnicity	**FSC students**		**non-FSC students**			
			Incoming Freshmen		Transfer Students	
	Head count	Percent	Head count	Percent	Head count	Percent
Black/African American	59	16.80%	104	19.19%	57	18.10%
Hispanic/Latino	60	17.00%	100	18.45%	25	7.94%
Asian	90	25.60%	165	30.44%	65	20.63%
White	143	40.60%	173	31.92%	168	53.33%
Total	352	100%	542	100%	315	100%
Data Source: UMass Boston Registrar’s Office (May 2013), author’s tabulations						

Figure 1: Distribution of students in the datasets by race and ethnicity



Data Source: UMass Boston Registrar’s Office (May 2013), author’s tabulations

[1] About 30% of all FSC students had “unknown”, “two or more”, or “not specified” as their reported race/ethnicity. This figure is nearly 25% for non FSC students and less than 20% for transfer students.

We organized our descriptive analyses around four themes: choice of major, status of FSC students in CSM, status of students in CSM by academic level, and summary statistics.

Choice of major

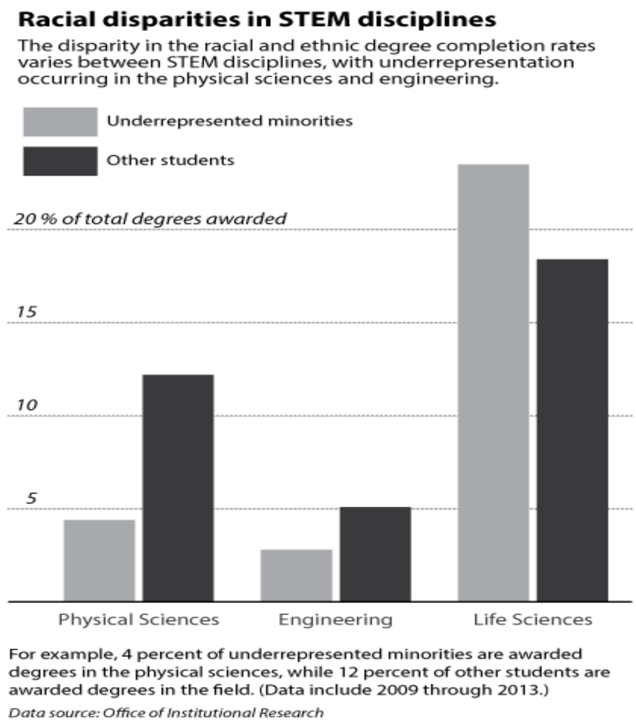
Biology seems to be a popular major among URM across all comparison groups. 51.3% URM chose the major among FSC participants while 43.9% URM who are non-FSC transfer students and 36.3% URM who are non-FSC incoming freshmen chose the major (See tables 2.a through 2.c in Appendix 4). 'High tech' majors (engineering and computer science) seem to be less popular among URM. The percentage of student choosing such majors fall between 0 and 13% in all compared groups. Among URM, Black/African American are even much less present in those 'high tech' majors, with rates as low as 3% for incoming freshmen URM in Engineering.

As of May 2013, about 7% of URM FSC students were undecided, a level comparable to 8% non-URM FSC students. This value is substantially higher at 38% and 22% respectively for Non FSC incoming freshmen. Therefore, participation in FSC seems to lower the incidence of undecided majors among minority students. Students who participated in FSC, by definition, have declared a major. Therefore, the fact that there is a low level of undecided FSC students is expected. However, as the data shows, not all of them remain in their original major, let alone in CSM. Thus, the fact that minority students' level of 'undecided' in non FSC group is so much higher than all the other groups indicates that participation in FSC has the potential to encourage minorities to remain in their STEM majors. A similar pattern is observed for the choice of majors among minority FSC students and minority non-FSC students. FSC seem to reduce the racial gap in 'high-tech' majors.

Non-FSC URM transfer students are less likely to be undecided similar Non FSC incoming freshmen, and the racial gap between 'high-tech' majors is a bit smaller (but not as relatively favorable as for FSC minority students). This could be explained by the fact that transfer students typically have a better idea of what they want to major in, given that they have prior experience in a post-secondary institution.

The trend in choice of major among URM at UMass Boston seems present in other institutions as well. For example, Jones (2013) reported that at Brown University URM students received 13.5 percent of undergraduate degrees in spring of 2013 but only 5.6 percent of the degrees in the physical sciences and 9 percent of the degrees in engineering (See Figure 2 below).

<u>Figure 2</u>: Underrepresented Minorities in STEM at Brown University



Source: Jones, 2013

Status of FSC students in CSM

Regardless of the comparison group, non-URM show higher rates of major declaration than do URM (See tables 3.a through 3.c in Appendix 4). However, those URM that have participated in FSC do show substantially higher level of declaration of major than do non-FSC incoming freshmen. This means that URM who participate in FSC have higher retention rates than their non-FSC URM peers. Non-FSC transfer students have higher level of major declaration than FSC students. Essentially, this is the other side of coin of the discussion on ‘undecided’ majors above.

As learning communities have been proven to be high-impact strategy in STEM retention (Zhao and Kuh, 2004, Price, 2005), we would expect high rates of student participants who stay in the STEM majors through their sophomore, junior, and senior years. This expectation holds true for a high percentage of FSC participants in the College of Science and Mathematics at

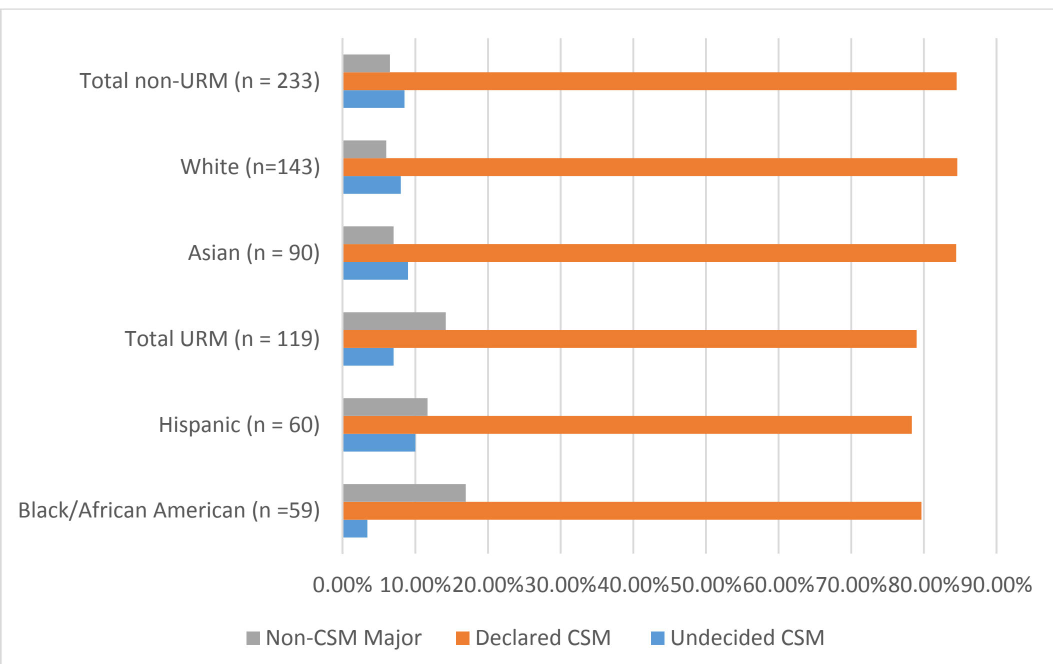
UMass Boston. Yet, a number of FSC students do not remain in CSM. The table below shows the distribution of FSC students by the 'undecided', 'declared' and 'non-CSM' categories. The number of URM students who participated in FSC but are no longer in the College of Science and Mathematics as of May 2013 is twice as high as its equivalent for non-URM. Table 2, below, shows the distribution of FSC students by their status in CSM. Figure 3, below, illustrates this distribution.

Table 2: Status of FSC students in CSM in May 2013

Race/Ethnicity	Undecided CSM		Declared CSM		non-CSM Major	
	N	%	N	%	N	%
Black/Afr. Am.(n =59)	2	3.39%	47	79.66%	10	16.95%
Hispanic (n = 60)	6	10.00%	47	78.33%	7	11.67%
Total URM (n = 119)	8	**6.70%**	94	**78.99%**	17	**14.20%**
Asian (n = 90)	8	9.00%	76	84.44%	6	7.00%
White (n=143)	12	8.00%	121	84.60%	9	6.00%
Total non-URM (n = 233)	20	**8.50%**	197	**84.50%**	15	**6.50%**
Difference (non-URM -URM)		1.80%		5.51%		-7.70%

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Figure 3: Status of FSC students in CSM in May 2013



Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Status of student in CSM by academic level

As we might expect, freshmen who participated in FSC have high levels of declared major (see Tables 4.a through 4.c in Appendix 4): 96% for Blacks, 81% for Hispanics, 92% for Asians and 84% for Whites. These numbers drop dramatically for all groups except for Whites when we consider non-FSC incoming freshmen: 61% for Blacks, 45% for Hispanics, 56% for Asians and 80% for Whites. CSM leaving seems to occur within the junior year and disproportionately affects URM. Among juniors in this sample who had participated in FSC, 40% Blacks and 45% Hispanics had a non-CSM major. These numbers were much lower for non-URM: 0% for Asians and 12% for Whites.

Summary statistics on GPAs and SAT scores

Non-URM and URM students who have participated in FSC have comparable high school GPAs. Yet, there is a 50-point difference in their SAT math score (See table 3). When we compare UMB cumulative GPAs, we see a moderate difference between the performances of URM students in FSC and their non-URM FSC peers (See Table 4). However, URM in FSC perform better than non-URM non-FSC students. Additional tables in Appendix 4 (Tables 5 through 9.c) provide more details on students' high school and college GPAs, cumulative credits and the differences across racial groups.

Table 3: High school preparation of FSC students

	URM students in FSC	
	# of obs.	Mean
High School GPA	119	3.35
Best SAT Math Score	119	520
	non-URM students in FSC	
High School GPA	233	3.31
Best SAT Math Score	233	571

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Table 4: Comparison of CSM students GPAs, by racial category

Mean GPA (all academic levels)			
Racial / Ethnic Category	FSC	non- FSC incoming freshman	non-FSC transfer
URM	2.77	2.66	2.20
non-URM	2.98	2.66	2.31
	0.21	0	0.11

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Overall, the administrative data point to higher academic achievement and retention of FSC students in STEM than for non-FSC students, though there appear to be distinctions in FSC student outcomes by underrepresented minority designation. In the following section, findings from qualitative interviews provide context for the positive outcomes displayed by FSC students.

Qualitative Findings

The qualitative analysis for this pilot study is based on original data collected through interviews. We interviewed a total of 10 individuals: four faculty and six students. Faculties interviewed were from the Environmental Science, Computer Science, Biology, and Physics departments. One of the faculty interviewed was a recent hire, but all have taught the gateway seminar. Students interviewed have participated in FSC from the following cohorts: Fall 2009, Fall 2011, and Fall 2012. Five students were African American/Black and one was Hispanic/Latino. A summary of participants' backgrounds is provided in Table 5 below.

Findings from the qualitative data are organized around the following themes:

- Student Experiences in FSC
- Faculty Support for students
- Barriers students face in STEM major
- Importance of the peer mentors

- Recommendations for FSC and for student retention in STEM

<u>Table 5</u>: Summary of respondents' backgrounds

Code name	Department	FSC Cohort
Faculty # 1	Environment (former EEOS)	2012
Faculty # 2	Physics	2012
Faculty # 3	Biology	2009, 2011
Faculty # 4	Computer Science	2011
Code name	**Gender, Level, and Current Major**	**FSC Cohort**
Student # 1	F/ Junior / Biology	2011
Student # 2	F/Junior / Biology	2011
Student # 3	F/Senior / American Studies (formerly Biology)	2009
Student # 4	M/Junior / Biology	2011
Student # 5	M/Senior /Biology	2009
Student # 6	M/Sophomore / Information Technology	2012

Student Experiences in FSC

Students and faculty alike described the Freshman Success Communities program as one that offers students an introduction to college life and helps them navigate an environment that is quite different from what they were accustomed to in high school. Most importantly, it is a program that allows them to meet like-minded peers with whom they share aspirations and who become their support system throughout their freshman year and beyond. The program offers a number of services that the students find valuable. When asked about the most useful resources that their gateway seminar provided for them, students usually mentioned more than one, echoing each other in many of their answers. *Access* was a recurring theme in those answers:

- *Access* to people with the knowledge of where to go to troubleshoot issues that come up during their academic journey
- *Access* to professors that knew them personally and could provide them with recommendation letters or sound advice on their post-career options
- *Access* to a social circle that makes their college life experience more enjoyable and also helps them to stay focused academically
- *Access* to practical knowledge such as how to use WISER or how to write a résumé

Students had unique ways of expressing the impact of Freshman Success Communities had on their experiences:

> "They helped me out on where to go and who to talk to." (Student #1)

> "We had most of our classes together and that was very helpful because the moving from classes to classes and in every class you have different faces was disconcerting to me, but with the FSC it was nice to be able to go to people and ask questions; we had help to register for our classes, when we had issues we knew who to go to, when we needed to know how to plan our semester; they have that 4 year plan that they gave us and I still use it when I choose my classes." (Student #2)

> "The program picked the classes for us; it helped us get all of our introductory courses out of the way and give us an idea of what to take in the next three years." (Student #3)

> "I enjoyed it, it was really fun getting to know students in my community. Like, I am still really good friends with all of them, and even meeting kids from other communities, that's been fun. I feel like I have been able to study with them and we help each other, so that was definitely helpful." (Student #4)

> "The fact that we were taking the same classes and we had people to study with, like minds, able minds made a difference. I felt empowered by the FSC, it enabled me to gage my own ability, to see where I should be if I am not there yet." (Student #5)

> "They basically gave me an introduction to how things work in the college; if it wasn't for the FSC I probably would be lost; the community provided resources like if I need anything who to go to (…)" (Student #6)

Faculty interviewed reiterated many of the observations made by the students. They unanimously agreed that given the nature of the UMB campus – i.e. nonresidential – the communities were much needed and justified.

> "It's a good thing, it get students together with each other, which I think is better than getting them together with faculty, because they are like a little team, they become friends; the best thing we do for support is providing them with mentors." (Faculty #2)

> "I think the biggest support was having someone that they were okay to let their guard down with; they had a bunch of peers; it was a comfortable space; they had a bunch of peers that were going through the same thing they were going through." (Faculty # 1)

> "I think what we're trying to do with Freshman Success Communities is good because people are commuters, so they don't necessarily have the time to stick

around so being able to work on academics with their fellow students, I think it's good" (Faculty # 4)

> "We are trying to form a community. We want students to interact with each other so that they feel like they are not alone at UMass with the argument being there are no dorms here so it's very easy for students to come in interact in a particular class and leave, so there's always a lot of team building initially." (Faculty #3)

Additionally students indicated that they were still in contact with the Gateway seminar classmates and advisor even after freshman year. Some mentioned that even when the bond was not as strong as during freshman year they would often reach out to each other to ask questions or set up study groups. All in all, the feedback on the FSC initiative was positive from both the faculty and student's perspectives.

Faculty Support for students

All students interviewed thought of faculty accessibility and support as a crucial element of their success here at UMass Boston. They believe that the fact that FSC gave them access to professors that were willing to assist them with any issues they were facing was an invaluable component of their success. The majority of students interviewed said they still had a relationship with their FSC instructor and could go to him/her for advice after their freshman year. Faculty interviewed as well reinforced importance of advising and contact with students:

> "I think advising, providing some personal care, making sure students are doing okay outside of the university and things are going okay inside the university; we can help them along the way." (Faculty # 1)

Barriers students face in STEM major

Students mentioned multiple barriers they faced as STEM majors at UMass Boston. One was the **pace of learning** in college that was very different to high school; another one was the challenge of **balancing school with work** and issues outside of UMass. The third one, related to the former is **financial need**.

Pace of learning

> "I think the pace of learning was very different from high school here; in Haiti the pace of learning was very intense, and then I moved here it was very laid back and then I came to college it was like that same intensity again so I was kind of lost, so it was kind of hard for me to find that balance that I used to have; that was difficult for me" (Student #1)

> "Here the coursework is at a much faster pace, in high school AP Calculus was like a whole year so it was not as consuming. Here you have to keep up with the pace." (Student #2)

> "AP Chemistry best prepared me for college because it was more time consuming so it prepared her for the amount of work load I would have in college." (Student #6)

> "I took AP calculus in high school; it exposed me to the caliber of difficulty I would have to go through, AP biology as well. I feel like my first year of college here was a repeat of high school, which was cool because I already knew what to expect, so AP courses were beneficial in that regard" (Student #5)

Work/School Balance and financial need

> "I had to pay for health care, so I worked throughout my freshman and sophomore years; that was hard. Afterwards I received a scholarship and that helped; that helped a lot." (Student #2)

> "I think one of the challenges for me has been working; my family, we recently moved here and we have our financial needs; working 20 hours a week was financially demanding, so it was kind of hard for me to manage my time between work and school." (Student #1)

Among the barriers mentioned, financial need particularly seems to affect URM significantly. Indeed, the barrier has been well documented by researchers. Malcolm, Dowd, and Yu (2010) suggested that achievement gaps in STEM for Hispanic students are largely due to lack of finances. They report that nearly 60% of Latino graduating college seniors work an average of 30 hours or more per week (Malcolm, Dowd, and Yu, 2010). Also, a recent study from the National Urban league (2014) revealed that 65 percent of African American college students are balancing work and family responsibilities while going to school.

Importance of the Peer mentors

Students and professors underscored the role of the peer mentors in the FSC. Mentors were seen as critical components of the program's architecture in many ways. First, the fact that they had been through what the students are going through made them immediately relatable to the freshmen. Second, the FSC students praised their availability and their willingness to provide advice and help them academically. Third, they were essential mediators between faculty and students in instances were freshmen were intimidated to approach faculty. Finally, they assisted faculty that had not previously taught the seminar.

> "We had the peer mentors; two of them were in class every day and that was helpful that they had someone who had been through that freshman year; and the other half of the time we spent on content, sort of pedagogy related to the sciences, all the sciences together." (Faculty #2)

> "I think the mentor was good because the students felt more at ease talking to her because she was more of their peer than I was, but I would have to say by the end of the semester and certainly the following semester I would say they felt just as comfortable talking to me as they were talking to anybody else." (Faculty #1)

> "I think the peer mentors have been very useful since they had been through the FSC themselves the year before, so they had things to share and experiences, also when things were going well and when things were not going well, that kind of feedback." (Faculty #3)

> "We had 2 or 3 mentors; the contact with them was pretty close. I don't think we were ever afraid to like approach them outside of the seminar; they considered us friends I think; they recommended us professors and kind of told us which classes we should take; If I was given the opportunity I will do it as well." (Student #4)

> "…having a mentor also helped, even to plan out your major. Being able to contact them via text with questions like 'should I take this class? What do you recommend?" (Student #2)

Recommendations for FSC administrators and for student retention in STEM[2]

Students and faculty interviewed for this pilot study made a number of recommendations for maintaining the quality of the FSC program and improving retention and success of students of URM STEM students at UMass Boston. We list these recommendations with the corresponding supporting quotes below:

- Incorporating the skills taught in FSC in an introductory course in order to reach a higher number of students with the same content and strategies for college survival (F)

> "I try to argue that everything we teach in the FSC we could teach it in [the introductory class] over two semesters but they say you can't do that because you can't use a freshman seminar as part of your requirements for your major…" (Faculty #2)

- Ensuring the peer mentors really understand the program and keeping this feature of the program (F/S)

> "As long as the peer mentors understand what the program is and are able to provide some form of ad hoc guidance to students who are here, then the program will be complete in my view" (Student #5)

- Encouraging students to build a community of their own even if they are not in FSC anymore or at all (S)

> "We worked together and looked at each other's lab reports and correct it because we were together all the time. I pretty much knew everyone in my classes within the first week so that helped, because we can talk to anyone via email; so when I had questions, I had help."(Student #2)

- Addressing financial barriers through funded research opportunities

> "Retention I think is about culture and peers and faculty support, undergraduate research, and I think we need more money; there are a lot of undergraduates that are doing jobs outside the university that they could get paid equivalently to do STEM related jobs on campus and they would get a much better educational experience, so I would love to have more funding to be able to fund research experiences for undergraduates; they're spending time on these outside jobs that they could be spending to enhance their education." (Faculty #1)

[2] (F) indicates quote(s) provided by a Faculty participant, (S) indicates a Student participant and (F/S) indicates both Faculty and Student.

- Slightly reduce the load of students during their freshman year (F/S)

> "The only problem I had is the spring semester of my freshman year, they kind of overloaded us with classes and that kind of pushed me back grade wise I thought." (Student #4)

> "These kids are taking 18 credits per semester in their freshman year. They are being overloaded from the onset of their college career." (Faculty #2)

- Maintaining the quality of the program by keeping small numbers of students (S)

> "I want everyone to have the same experience as we did because I think that's a great thing if that's achievable but I don't want the quality of the program to decrease because so many students are incorporated; so its quantity versus quality. I think the more students they have, the less the quality will be." (Student #2)

- Encouraging FSC students to help other students who have not participated in the program (S)

> "We are bringing the idea of helping freshmen in CSM with similar information that we received in the FSC; we brought it up to Dean, it's still in discussion but he is supportive of it. I think it's significant if we can make a difference for others. Having mentors, help me personally so I said I would gladly help someone else too." (Student #1)

- Accommodating students with different levels of preparation with different communities (F/S)

> "I liked that my community was split into two: those who placed into Pre-Cal and those who placed in Algebra" (Student #4)

> "A recommendation would be to see if students with different levels of preparation could be chosen for the program and group them in communities according to respective levels so that they are all starting at the same level." (Student #5)

- Making advising proportional to student growth (F/S). Group advising was suggested as one way of achieving this.

> "Compared to when I was a freshman here, the student population has grown vastly and the number of faculty hasn't; at least that's a disparity that at least the FSC is addressing." (Student #5)

> "Group advising whether it is informal or formal [could improve student retention]; they could compare on notes on things they're doing, jobs they're looking at etc…some of that is happening in individual lab groups; there's 3 undergraduate students who are working with graduate students in my lab." (Faculty #1)

- Aggressive hiring of minority faculty in order to increase minority numbers in certain STEM fields (e.g. Environmental Science, Computer Science) (F)

> "Very small numbers of African American students choose computer science and we've always wondered why. We've had all kinds of theories…we kind of know why women don't go into it because it is very solitary. I assume why lots of African Americans - it is only an assumption – is culture. They don't see role models in the field. I go to conferences in my field and I look around and there's maybe 1 African American out of 200 people." (Faculty #4)

> "The numbers of URM in EEOS as well are very low; out of 12 students you might have about 2 URM; part of that is because these populations often don't get prior outdoor experiences that spark interest in the field; with other disciplines like Biology, they have role models on TV that are doctors." (Faculty #1)

- Emphasis on teaching introductory courses (F)

> "Put some emphasis on teaching the intro courses; if they are taught well, they are engaging, they're interesting people like them then it gets them interested, so I put a lot of time in that intro class as a recruiting mechanism." (Faculty #1)

> "If they can get through those first two courses relatively well, that is a C or better, they can usually make it. A lot of students don't even make it through the class…maybe a third." (Faculty #4)

- Providing FSC students with a physical space to work on homework and projects (F)

> "A community needs a place to be, they have to have place where they can all come together. The students need a place that they can call their own" (Faculty #2)

- Spending more time on informing students upfront about expectations of the College of Science and Mathematics and being a STEM major (S)

> "As a peer mentor, I got to see a wide range of students, their work ethic and their drive; maybe there should be more info session with students, face to face time to explain so they know what to expect from the FSC, so that

they know what they're getting themselves into; to be honest I didn't know what to expect either but my sister went here and she was a biology major, so I was like if she can do it, I can do it do, so that was my mentality." (Student #5)

- Sensitivity to student's environment and issues outside of UMass Boston (F/S)

> "Not everyone has a same background, but I think that's a little harder when you are a minority; there are a lot of things going on outside of school, like it's not only about school, you know I think that's a huge deal." (Student #5)

> "A lot of persistence comes from the families and I don't think we really think about that so much in higher education as we do in k-12; internal family support and motivation for the choice of their STEM majors can do a lot for persistence." (Faculty #1)

- Encouraging students to take full advantage of resources available to them (F)

> "Students do not use resources as much as we'd like them to. I sit around here during office hours by myself, you know it's the old story of the better student coming along." (Faculty #4)

Discussion

Freshman Success Communities, UMass Boston's College of Science and Mathematics learning community model, started in the Fall of 2009. It followed the cluster community design described in Tinto (2003), co-enrolling students in the same classes and linking them with a freshman seminar. Four years since its inception, a number of positive outcomes have been achieved from this model, based on the results from this pilot study. The findings from this study and the College of Science and Mathematics reports corroborate the claim from previous work that LCs enhance student learning and improve academic performance (Zhao and Kuh, 2004; Price, 2005; Andrade, 2007; Weaver et al. 2009; Kuh, 2010). FSC students at UMass Boston show higher GPAs and credit accumulation than their non-FSC counterparts. Minorities who participate in FSC appear to reap substantial benefits from the program as they not only had higher GPAs than their non-FSC counterparts but they also showed lower levels of leaving their STEM majors (said differently, higher level of retention). However, the evidence we have gathered so far indicates that within FSC non-URM perform better than URM.

We found that the initial barriers that students face in the College of Science and Mathematics are the pace of college learning and the limited financial resources. All students interviewed noted that the work load in they found at UMB is substantially higher than what they were expected to do in high school. The upper level students credited the learning community for helping them adjust to this new pace of learning. Students said they chose UMass Boston for the affordability of the school and two expressed financial concerns related to completing their education. These students explained that it was challenging to hold a job while going to school but they had to do so to support their families. One of the recommendation offered by faculty, increasing opportunities for funded undergraduate research, could address such concerns. The approach to keep students away from non-STEM related jobs and compensating them with opportunities that are paid and more related to their studies seems appropriate.

Although no multivariate analyses were performed, some characteristics of FSC stood out as critical factors for the positive educational outcomes of students. The first and most cited one was the social circle of academically-minded students it provided for the participants. Students enjoyed collaborative work and mutual help with their fellow FSC members. This provided them with a sense of belonging and a safe, non-judgmental space for academic growth. The second was the permanent access to their faculty and peer mentors. Students especially appreciated the availability and responsiveness of peer mentors.

Generally, the qualitative interviews results provide an adequate illustration of the characteristics identified by Tinto (2003): *shared knowledge, shared knowing*, and *shared responsibility*. The students and faculty all made references to these aspects of the College of Science and Mathematics' learning community model. As encouraging as all of this positive feedback is, it remains important to acknowledge, as previous researchers did, that LCs are not a silver bullet for STEM retention and success (Tinto, 2003). Students interviewed for this project all underscored the importance of high school preparation and financial resources. The literature as well points to many other high impact interventions. The challenge for UMass Boston, then, particularly the College of Science and Mathematics, is to identify among the proven strategies which combination is most appropriate for the population served.

We summarize our discussion and answers to our research questions in table 6 below.

<u>Table 6</u>: answers to research questions

Research Question	Finding
1. What initial barriers to success in STEM majors are faced by minority students with freshman standing? Are they unique or distinctive from other students?	Initial barriers faced by minorities in STEM at UMass Boston include the pace of learning, the work/school Balance and financial need. Although these barriers may not be unique to URM students in CSM, recent research by Malcolm, Dowd, and Yu (2010) and the National Urban League (2014) suggest that these challenges disproportionately affect URM.
2. What internal characteristics and external factors of FSC are associated with improved educational outcomes?	The cohort design of FSC, an emphasis on community building, and access to resources seem to be driving positive outcomes associated with participation in the learning community. Furthermore, the informal community that exists among participants beyond the freshman year seems to sustain the positive student experience (and most likely student outcomes).
3. What are the characteristics of FSC participants who persist in CSM's course of study?	This question is one that would be better answered with a longitudinal data set, but this project along with CSM reports indicates that FSC students have higher persistence rates. However, non-URM students within FSC appear to have higher GPAs than URM.
4. Have CSM's Freshman Success Communities reduced the achievement gap between minority and non-minority students?	FSC seem to improve performance of URM, but we observe a modest disparity between URM and non-URM GPAs within FSC. However, URM FSC students perform better than non-FSC non-URM students
5. What aspects of learning communities have been adapted by CSM's FSC initiative?	College of Science and Mathematics learning community model is referred to as the «cluster» model, linking introductory courses to a freshman seminar.
6. What aspects of learning communities have been adapted by CSM's FSC initiative?	College of Science and Mathematics learning community model is referred to as the "cluster" model, linking introductory courses to a freshman seminar.

Table 6: answers to research questions (continued)

Research Question	Finding
7. In what ways are FSCs connected to other UMass Boston undergraduate-level STEM enrichment programs?	We compiled a list of undergraduate-level STEM enrichment programs for which UMB is a lead or partner; we have not determined how they are connected to FSC. Such programs include: Noyce Scholars program, Boston Science Partnership, Bridges to Baccalaureate program (See Appendix 2 for more details).
8. What other innovations from learning communities literature could enhance the impact of CSM's FSC model?	CSM's FSC model has already been modified to better serve students. The program now includes two versions of the "cluster" model. An additional innovation could be the use of analytics to purposefully target students who would reap the most benefits from the learning community.

VII. Research Limitations

Given the restrictions on resources with which we conducted this study, there are some limitations to the research. First, the quantitative results are only reflective of selected variables on CSM students as of May 2013; therefore, the study only provides snapshot data as the data set used was not longitudinal. Longitudinal datasets offer the opportunity to examine data trends over time. In this examination of the impact of learning communities, being able to track trends in student's success over time can add a significant level of accuracy to the results.

Second, the recruitment of students for interviews was particularly challenging. Only 50% of the intended sample was interviewed. Four out of the six students interviewed were from the same major: Biology. A fifth respondent was a former Biology major who switched to a non-STEM major and the sixth respondent was an information technology major. While this provided for an interesting mix of perspectives, results should be interpreted with this caveat in mind. Students from many other important STEM majors such as Mathematics, Physics, or Environmental Science could add some valuable perspectives as well. In fact, such majors having the lowest records for minority students, the few that are present in them could provide some important insight on their academic experiences and how to increase URM participation in them.

Third, the program being fairly new, the first cohort of FSC students just graduated in Summer 2013, for those who did on time. This means that it is not possible to look at their post-graduation outcomes. This study could have been enhanced with the inclusion and discussion of post-graduation outcomes.

Fourth, only FSC students were interviewed in this pilot study. Further qualitative research in STEM retention at UMB should include the non-FSC students. An investigation into their academic and social experiences and the way they differ from those of their peers who participate in learning communities will add an essential piece of knowledge to this inquiry.

Finally, some other variables and analyses could have been performed with the data but were not given the limited amount of time to allot to this. For example, math placement data for all students in the data sets acquired could have been an additional parameter of the study. In a similar vein, analysis of students' grades in introductory courses will also reveal important information on initial success of STEM students at UMass Boston. Additionally, student grades in introductory courses would be important to look at. Interesting multivariate analyses could have been performed with such data, as well as the GPA and the cumulative credits variables that were available in the datasets. Still, the descriptive analyses from the pilot study provide preliminary results that lay the foundation for a subsequent, larger scale study.

Conclusion, Recommendations and Next Steps

According to Carnevale et al (2011), the US education system is not producing enough STEM-graduates to keep up with demand both in traditional STEM occupations and other sectors across the economy that demand similar competencies. Ninety two percent of STEM jobs require a post-secondary degree (Carnevale et al., 2011). Higher education researchers suggest that to address this STEM challenge, greatest gains will likely come from the development of strategies to implement proven instructional strategies rather than further investigating more strategies (Fairweather, 2010). Based on results from this pilot study and the literature, learning communities appear to be a high impact pedagogical approach. Students and faculty interviewed for this report by and large viewed it in a positive light. Some recommendations for maintaining and improving the quality of the program can be yielded from this study: keeping the peer mentors and making sure they understand the catalytic role they play in the retention and success of their fellow STEM students, finding creative ways to expand the program's services to a larger population of students, keeping small numbers in the FSC cohorts as well as the layered model, and offering physical spaces to learning community participants to solidify their academic collaboration and socialization.

Next steps in this research can include the creation of a longitudinal database with all CSM students both FSC participants and non-participants. This database could be complemented by an annual survey of graduates also with FSC and non-FSC students. Such tools will greatly improve the monitoring of outcomes provided by the learning communities. While this study was focused on minorities, additional investigation incorporating gender could be useful as well. Furthermore, we are unsure about the extent of collaboration across the various undergraduate level STEM enrichment programs and the FSC program. An important next step in this project is leveraging the combined assets of these programs for the benefit of FSC students.

With STEM playing a vital role in Massachusetts growth strategy, Governor Deval Patrick welcomed and applauded the UMass system for recognizing the importance of STEM and looks forward to working with the system's leaders to implement a successful program that will ensure that all UMass system's students are prepared for careers in the 21st century global economy (Bay State Banner, 2012). Though designing and implementing the proposed next steps in this work will inevitably require substantial resources, it is likely that the investment will pay off in the form of growth in STEM graduates in the long run.

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<u>Appendix 1</u>: Glossary

The following are the working definitions of concepts used in this paper:

Academic Level: student classification based on the Freshman, Sophomore, Junior, Senior categories as defined by UMass Boston

Comparison categories

FSC participants: Students who participated in FSC based obtained from CSM

Non-FSC incoming freshmen: students who came in as freshmen to UMB CSM and did not participate in FSC

Non-FSC transfer students: Students who came to UMB CSM as transfer students and did not participate in FSC

Cumulative UMB credits: cumulative UMB credits of students in data set as of May 2013

Cumulative UMB GPA: cumulative UMB GPA of students in data set as of May 2013

Difference (non-URM – URM): difference between observed values of given variable for non-URM versus URM students in data sets provided

Entry Status: whether student comes in as first time freshman (i.e. incoming freshman) or transfer student [UMB Office of Institutional Research definition]

Freshman Success Communities: An initiative of the College of Science and Mathematics by which freshmen CSM students study and socialize in small cohorts and receive academic and professional enrichment to increase the likelihood of academic success.

High School Preparation: previous skills earned by entering STEM majors as indicated by SAT scores and placement tests in math and reading

Initial Success: performance in required introductory courses for core majors offered by the College of Science and Mathematics

Majority-minority: A population which in which minorities account for more than 50 percent.

Minority: For the purposes of this project, we focus on students who self-describe their race/ethnicity as African-descent or Hispanic/Latino

Persistence: re-enrollment from one year to the next [UMB Office of Institutional Research definition]

Race/Ethnicity: Category used to describe groups to which individuals belong, identify with, or belong in the eyes of the community. The categories do not denote scientific definitions of anthropological origins. For the purposes of this project, a person may be counted in only one group. [UMB Office of Institutional Research definition]

Racial/Ethnic categories

Non-underrepresented minorities (non-URM): White/Caucasian and Asian

Under-represented minorities (URM): African American/Black and Hispanic/Latino

Retention rates: percent of students in an entering cohort who complete one year of study and return for the next year of study [UMB Office of Institutional Research definition]

STEM: academic majors and research disciplines in science, technology, engineering and mathematics

STEM major at UMass Boston: any student enrolled in UMass Boston's College of Science and Mathematics who has a declared major

Success: ability to complete a course of study, including (but not limited to) the following: "graduation rates"; "initial success"; "persistence"; "retention rate"; "post-graduation outcomes"

Underrepresented: those demographic groups/communities that have traditionally participated in or benefitted from programs at a lower rate than the participant population overall, or as compared to the majority population

<u>Appendix 2</u>: Initiatives aiming to improve student success in STEM in which UMass Boston is lead or partner

1. <u>Boston Science Partnership (BSP)</u>

The BSP brings together three core partners. The partners are Boston Public Schools, Northeastern University, and the University of Massachusetts Boston as the lead organization along with two supporting partners, Harvard Medical School and the College Board. The BSP project began in September 2004 and is funded by a five-year, $12.5 million Math Science Partnership grant from the National Science Foundation. Its purpose is to purpose is to improve science education in Boston from middle school through graduate school. The partnership has a vision to provide:

- Challenging science courses taught by highly qualified science teachers throughout the Boston Public Schools
- Advanced Science courses that are accessible to all Boston Public School students
- University Faculty who work side-by-side with Boston Public School science teachers in science education reform
- Support structures to promote student achievement in science, from grade six through graduate school
- Strategies that have a broad impact on urban school systems nationwide

2. <u>Bridges to the Baccalaureate Program</u>

The Bridges to the Baccalaureate Program is funded by the National Institutes of Health and managed by the Leadership, Excellence, & Acceleration Projects (LEAPs) at the University of Massachusetts Boston, in Partnership with Bunker Hill Community College and Roxbury Community College. The objective of the Bridges Program is to advance the careers of community college students interested in pursuing a biomedical research career. Participants in the Bridges program receive practical training in modern laboratory techniques and then are placed in supportive UMB and associated research laboratory working environments where they establish peer/mentor relationships. Bridges participants are paired with junior and senior-year undergraduate students, minority graduate students or supportive staff research associates.

3. COSMIC

The Center of Science and Mathematics in Contex (COSMIC) serves as a bridge among the various Colleges of the University of Massachusetts Boston campus. COSMIC sees, as one of its roles, insuring that students receive the best educational experience possible and provides support for science teachers beginning with their teacher training at UMass and continuing with professional development through their teaching career path. For pre-college students, COSMIC develops innovative science curriculum materials and conducts research studies on their effectiveness.

4. UMB Noyce Scholars Program

Building on two long-standing urban teacher preparation programs, Teach Next Year and the Urban Teacher Educator Corp., the University of Massachusetts Boston's Noyce Scholars Program is recruiting and preparing talented science, technology, engineering and mathematics (STEM) undergraduates and professionals, particularly those from underrepresented groups, for urban teaching careers. The Noyce Scholars Program is a partnership made up of faculty from the College of Science and Mathematics, the Graduate College of Education and the Boston Public Schools. The partnership aims to increase the number of K-12 certified mathematics and science teachers by providing scholarships, teacher preparation courses, workshops, internships in urban schools and one-on-one professional coaching.

5. Urban Massachusetts Louis Stokes Alliance for Minority Participation (UMLSAMP)

The National Science Foundation (NSF) funded Urban Massachusetts Louis Stokes Alliance for Minority Participation (UMLSAMP) is a program led by UMass Boston and is comprised of seven other institutions: UMass Dartmouth, UMass Lowell, Wentworth Institute of Technology; and Bristol, Bunker Hill, Roxbury, and Middlesex community colleges. Supportive of the graduation of all undergraduate and graduate students in the Commonwealth of Massachusetts, the UMLSAMP is designed to create an integrated 'Community of Science' culture and learning group for 800 to 1,000 underrepresented students at the Alliance institutions majoring in STEM fields. UMLSAMP collaborates with other supportive STEM departments and projects at each institution to provide quality academic and research based experiences. UMLSAMP also provides an opportunity for a 5-10 year integrated strategic plan among urban institutions for higher learning for the growth of STEM graduates from diverse backgrounds who will participate in the high technology institutions and enterprises of the eastern half of Massachusetts.

Appendix 3: Project Timeline

Project activities 2012 -2013	2012				2013								
	Sep	**Oct**	**Nov**	**Dec/Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**July**	**Aug**	**Sep**	**Oct**
Project discussions				BREAK									
Initial Literature Review and Project Prospectus													
Project IRB Approval													
Meetings with CSM													
ODI data analysis													
Faculty/Students recruitment and interviews													

Project activities 2013 -2014	2013		2014				
	Nov	**Dec/Jan**	**Feb**	**Mr**	**Apr**	**May**	**Jun**
Interview transcriptions		BREAK					
Additional literature review & Writing							
Final Report Presentation							

<u>Appendix 4:</u> Administrative data analysis tables

Table 1) Distribution of FSC students by Major

Race/Ethnicity	FSC students		non-FSC students			
			Incoming Freshmen		Transfer Students	
	Head count	Percent	Head count	Percent	Head count	Percent
Black/African American	59	16.80%	104	19.19%	57	18.10%
Hispanic/Latino	60	17.00%	100	18.45%	25	7.94%
Asian	90	25.60%	165	30.44%	65	20.63%
White	143	40.60%	173	31.92%	168	53.33%
Total	352	100%	542	100%	315	100%

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Table 2.a) Distribution of FSC students by Major

MAJOR		Black/Afr.Am*.	Hispanic	*Total URM*	Asian	White	*Total non-URM*	Difference* [non-URM – URM]
# of observations		N =59	N=60	N = 119	N = 90	N=143	N = 233	
Biology	**N**	35	26	61	45	56	101	
	%	59.32%	43.33%	**51.26%**	50.00%	39.16%	**43.34%**	-7.92%
Chemistry /Biochemistry	**N**	8	13	21	14	28	42	
	%	13.56%	21.67%	**17.65%**	15.56%	19.58%	**18.03%**	0.38%
IT / Computer Science	**N**	3	4	7	9	15	24	
	%	5.08%	6.67%	**5.88%**	10.00%	10.49%	**10.30%**	4.42%
Other (Math & EEOS)	**N**	0	1	1	3	14	17	
	%	0.00%	2%	**0.84%**	3.33%	9.79%	**7.30%**	6.46%
Engineering/Physics	**N**	1	3	4	5	9	13	
	%	1.69%	5.00%	**3.36%**	5.56%	6.29%	**5.58%**	2.22%
Undecided	**N**	2	6	8	7	12	19	
	%	3.39%	10.00%	**6.72%**	7.78%	8.39%	**8.15%**	1.43%

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

*: Afr.Am. stands for African American

Table 2.b) Distribution of non-FSC incoming freshmen by Major

MAJOR		Black/Afr.Am.	Hispanic	***Total URM***	Asian	White	***Total non-URM***	Difference* [non-URM – URM]
# of observations		N =104	N= 100	N = 204	N = 165	N=173	N = 338	
Biology	**N**	42	32	74	40	68	108	
	%	40.38%	32.00%	**36.27%**	24.24%	39.31%	**31.95%**	-4.32%
Chemistry /Biochemistry	**N**	6	8	14	28	18	46	
	%	5.77%	8.00%	**6.86%**	16.97%	10.40%	**13.61%**	6.75%
IT / Computer Science	**N**	16	10	26	30	20	50	
	%	15.38%	10.00%	**12.75%**	18.18%	11.56%	**14.79%**	2.05%
Other (Math & EEOS)	**N**	3	6	9	10	28	38	
	%	2.88%	6%	**4.41%**	6.06%	16.18%	**11.24%**	6.83%
Engineering/Physics	**N**	3	3	6	9	13	22	
	%	2.88%	3.00%	**2.94%**	5.45%	7.51%	**6.51%**	3.57%
Undecided	**N**	34	41	75	48	26	74	
	%	32.69%	41.00%	**36.76%**	29.09%	15.03%	**21.89%**	-14.87%

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Table 2.c) Distribution of non-FSC transfer students by Major

MAJOR		Black/Afr.Am.	Hispanic	*Total URM*	Asian	White	*Total non-URM*	Difference* [non-URM – URM]
# of observations		N=57	N = 25	N= 82	N = 65	N = 168)	N = 233	
Biology	**N**	24	12	36	27	64	91	
	%	42.10%	48.00%	**43.90%**	41.54%	38.10%	**39.06%**	-4.85%
Chemistry /Biochemistry	**N**	8	0	8	5	14	19	
	%	14.04%	0.00%	**9.76%**	7.69%	8.33%	**8.15%**	-1.60%
IT / Computer Science	**N**	6	5	11	16	29	45	
	%	10.53%	20.00%	**13.41%**	24.62%	17.26%	**19.31%**	5.90%
Other (Math & EEOS)	**N**	5	4	9	4	39	43	
	%	8.77%	16%	**10.98%**	4.44%	27.27%	**18.45%**	7.48%
Engineering/Physics	**N**	0	3	3	4	7	11	
	%	0.00%	12.00%	**3.66%**	4.44%	6.29%	**4.72%**	1.06%
Undecided	**N**	14	1	15	9	15	24	
	%	24.56%	4.00%	**18.29%**	10.00%	10.49%	**10.30%**	-7.99%

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Table 3.a) Distribution of FSC students by CSM status

Race/Ethnicity	Undecided CSM		Declared CSM		non-CSM Major	
	N	%	N	%	N	%
Black/Afr. Am.(n =59)	2	3.39%	47	79.66%	10	16.95%
Hispanic (n = 60)	6	10.00%	47	78.33%	7	11.67%
Total URM (n = 119)	8	**6.70%**	94	**78.99%**	17	**14.20%**
Asian (n = 90)	8	9.00%	76	84.44%	6	7.00%
White (n=143)	12	8.00%	121	84.60%	9	6.00%
Total non-URM (n = 233)	20	**8.50%**	197	**84.50%**	15	**6.50%**
Difference (non-URM – URM)		1.80%		5.51%		-7.70%

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Table 3.b) Distribution of non-FSC incoming freshmen by CSM status

Race/Ethnicity	Undecided CSM		Declared CSM		non-CSM Major***	
	N	%	N	%	N	%
Black/Afr. Am. (n =104)	34	32.69%	70	67.31%	~~0~~	~~0.00%~~
Hispanic (n = 100)	41	41.00%	59	59.00%	~~0~~	~~0.00%~~
Total URM (n = 204)	75	**36.76%**	129	**63.24%**	~~0~~	~~0.00%~~
Asian (n = 165)	48	29.09%	117	70.91%	~~0~~	~~0.00%~~
White (n=173)	26	15.03%	147	84.97%	~~0~~	~~0.00%~~
Total non-URM (n = 338)	74	**21.89%**	264	**78.11%**	~~0~~	~~0.00%~~
Difference (non-URM – URM)		-14.87%		14.87%		~~0.00%~~

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

***: the strikethrough numbers represent unavailable data

Table 3.c) Distribution of non-FSC transfer students by CSM status

Race/Ethnicity	Undecided CSM		Declared CSM		non-CSM Major***	
	N	**%**	N	**%**	N	%
Black/Afr. Am. (n =57)	14	24.56%	43	75.44%	~~0~~	~~0.00%~~
Hispanic (n = 25)	1	4.00%	24	96.00%	~~0~~	~~0.00%~~
Total URM (n = 82)	15	**18.29%**	67	**81.71%**	~~0~~	~~0.00%~~
Asian (n = 65)	9	13.85%	56	86.15%	~~0~~	~~0.00%~~
White (n=168)	15	8.92%	153	91.07%	~~0~~	~~0.00%~~
Total non-URM (n = 233)	24	**10.30%**	209	**89.70%**	~~0~~	~~0.00%~~
Difference		-7.99%		7.99%		~~0.00%~~

Data Source: UMass Boston Registrar’s Office (May 2013), author’s tabulations

Table 4.a) Distribution of FSC students by CSM status and academic level

		Black / African American			
		Freshmen (n = 27)	Sophomores (n =10)	Juniors (n = 15)	Seniors (n =7)
Undecided CSM	**N**	1	0	1	0
	%	3.70%	0.00%	6.67%	0.00%
Declared CSM	**N**	26	7	8	6
	%	96.30%	70.00%	53.33%	85.71%
non-CSM Major	**N**	0	3	6	1
	%	0.00%	30.00%	40.00%	14.29%
		Hispanic			
		Freshmen (n = 26)	Sophomores (n = 16)	Juniors (n = 11)	Seniors (n = 7)
Undecided CSM	**N**	5	1	0	0
	%	19.23%	6.25%	0.00%	0.00%
Declared CSM	**N**	21	14	6	6
	%	80.77%	87.50%	54.55%	85.71%
non-CSM Major	**N**	0	1	5	1
	%	0.00%	6.25%	45.45%	14.29%

Data Source: UMass Boston Registrar’s Office (May 2013), author’s tabulations

Table 4.a) Distribution of FSC students by CSM status and academic level (continued)

		Asian			
		Freshmen (n = 38)	Sophomores (n = 20)	Juniors (n = 20)	Seniors (n = 12)
Undecided CSM	**N**	2	3	3	0
	%	5.26%	15.00%	15.00%	0.00%
Declared CSM	**N**	35	13	17	11
	%	92.11%	65.00%	85.00%	91.67%
non-CSM Major	**N**	1	4	0	1
	%	2.63%	20.00%	0.00%	8.33%
		White			
		Freshmen (n = 53)	Sophomores (n = 36)	Juniors (n = 25)	Seniors (n = 29)
Undecided CSM	**N**	7	4	1	0
	%	13.21%	11.43%	4.00%	0.00%
Declared CSM	**N**	45	27	21	28
	%	84.91%	77.14%	84.00%	96.55%
non-CSM Major	**N**	1	4	3	1
	%	1.89%	11.43%	12.00%	3.45%

Data Source: UMass Boston Registrar’s Office (May 2013), author’s tabulations

Table 4.b) Distribution of non-FSC incoming freshmen by CSM status and academic level

		Black / African American			
		Freshmen (n = 33)	Sophomores (n =34)	Juniors (n = 17)	Seniors (n =20)
Undecided CSM	**N**	13	14	6	1
	%	39.39%	41.18%	35.29%	5.00%
Declared CSM	**N**	20	20	11	19
	%	60.61%	58.82%	64.71%	95.00%
non-CSM Major	**N**	0	0	0	0
	%	0.00%	0.00%	0.00%	0.00%
		Hispanic			
		Freshmen (n = 44)	Sophomores (n = 30)	Juniors (n = 15)	Seniors (n = 11)
Undecided CSM	**N**	24	8	8	1
	%	54.55%	26.67%	53.33%	9.09%
Declared CSM	**N**	20	22	7	10
	%	45.45%	73.33%	46.67%	90.91%
non-CSM Major	**N**	~~0~~	~~0~~	~~0~~	~~0~~
	%	~~0.00%~~	~~0.00%~~	~~0.00%~~	~~0.00%~~

Data Source: UMass Boston Registrar’s Office (May 2013), author’s tabulations

Table 4.b) Distribution of non-FSC incoming freshmen by CSM status and academic level (continued)

		Asian			
		Freshmen (n = 55)	Sophomores (n = 47)	Juniors (n = 23)	Seniors (n = 40)
Undecided CSM	**N**	24	14	8	2
	%	43.64%	29.79%	34.78%	5.00%
Declared CSM	**N**	31	33	15	38
	%	56.36%	70.21%	65.22%	95.00%
non-CSM Major	**N**	~~0~~	~~0~~	~~0~~	~~0~~
	%	~~0.00%~~	~~0.00%~~	~~0.00%~~	~~0.00%~~
		White			
		Freshmen (n = 55)	Sophomores (n = 36)	Juniors (n = 20)	Seniors (n = 62)
Undecided CSM	**N**	11	10	3	2
	%	20.00%	27.78%	15.00%	3.23%
Declared CSM	**N**	44	26	17	60
	%	80.00%	72.22%	85.00%	96.77%
non-CSM Major	**N**	~~0~~	~~0~~	~~0~~	~~0~~
	%	~~0.00%~~	~~0.00%~~	~~0.00%~~	~~0.00%~~

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Table 4.c) Distribution of non-FSC transfer students by CSM status and academic level

		Black / African American			
		Freshmen (n = 4)	Sophomores (n =16)	Juniors (n = 14)	Seniors (n =23)
Undecided CSM	**N**	1	11	1	1
	%	25.00%	68.75%	7.14%	4.35%
Declared CSM	**N**	3	5	13	22
	%	75.00%	31.25%	92.86%	95.65%
non-CSM Major	**N**	~~0~~	~~0~~	~~0~~	~~0~~
	%	~~0.00%~~	~~0.00%~~	~~0.00%~~	~~0.00%~~
		Hispanic			
		Freshmen (n = 1)	Sophomores (n = 5)	Juniors (n = 9)	Seniors (n = 10)
Undecided CSM	**N**	0	1	0	0
	%	0.00%	20.00%	0.00%	0.00%
Declared CSM	**N**	1	4	9	100
	%	100.00%	80.00%	100.00%	100.00%
non-CSM Major	**N**	~~0~~	~~0~~	~~0~~	~~0~~
	%	~~0.00%~~	~~0.00%~~	~~0.00%~~	~~0.00%~~

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Table 4.c) Distribution of non-FSC transfer students by CSM status and academic level (continued)

		Asian			
		Freshmen (n = 4)	Sophomores (n = 9)	Juniors (n = 27)	Seniors (n = 25)
Undecided CSM	**N**	2	2	5	0
	%	50.00%	22.22%	18.52%	0.00%
Declared CSM	**N**	2	7	22	25
	%	50.00%	77.78%	81.48%	100.00%
non-CSM Major	**N**	~~0~~	~~0~~	~~0~~	~~0~~
	%	~~0.00%~~	~~0.00%~~	~~0.00%~~	~~0.00%~~
		White			
		Freshmen (n = 8)	Sophomores (n = 40)	Juniors (n = 48)	Seniors (n = 72)
Undecided CSM	**N**	4	4	5	2
	%	50.00%	10.00%	10.42%	2.78%
Declared CSM	**N**	4	36	43	70
	%	50.00%	90.00%	89.58%	97.22%
non-CSM Major	**N**	0	0	0	0
	%	~~0.00%~~	~~0.00%~~	~~0.00%~~	~~0.00%~~

Data Source: UMass Boston Registrar’s Office (May 2013), author’s tabulations

Table 5) Summary statistics of FSC student characteristics (cumulative credits, UMB GPA, Best SAT math score)

All FSC students					
	URM students in FSC				
	# of observations	Mean	Std. Dev	Minimum	Maximum
Cumulative Credits	119	39	28.33	0	124
Cumulative UMB GPA	119	2.77	0.62	0.00	4.00
High School GPA	119	3.35	0.45	2.38	4.28
Best SAT Math Score	119	520	69.80	400	750
	non-URM students in FSC				
Cumulative Credits	233	42	29.2	0	125
Cumulative UMB GPA	233	2.97	0.68	0.00	4.00
High School GPA	233	3.31	0.63	0.00	4.65
Best SAT Math Score	233	571	76.69	400	800

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Table 6.a) Average Cumulative UMB GPAs **for FSC students by academic level**

Race/ethnicity	# of observations	Mean	Std. Dev	Minimum	Maximum
Black/African American					
Freshmen	27	2.72	0.69	1.28	4.00
Sophomores	10	2.31	0.68	1.18	3.56
Juniors	15	2.85	0.41	2.16	3.90
Seniors	7	2.88	0.51	2.17	3.68
Hispanic					
Freshmen	26	2.76	0.78	0.00	3.85
Sophomores	16	2.94	0.42	2.07	3.62
Juniors	11	2.71	0.40	2.03	3.53
Seniors	7	3.13	0.41	2.43	3.55
Asian					
Freshmen	38	3.16	0.67	1.43	3.96
Sophomores	20	2.75	0.65	1.77	3.85
Juniors	20	2.99	0.50	1.60	3.98
Seniors	12	3.03	0.57	2.21	4.00
White					
Freshmen	53	2.93	0.91	0.00	4.00
Sophomores	36	2.83	0.65	1.50	4.00
Juniors	25	3.05	0.55	2.05	3.92
Seniors	29	3.10	0.38	2.07	3.81

Data Source: UMass Boston Registrar’s Office (May 2013), author’s tabulations

Table 6.b) Average Cumulative UMB GPAs **for non-FSC incoming freshmen by academic level**

Race/ethnicity	# of observations	**Mean**	**Std. Dev**	**Minimum**	**Maximum**
Black/African American					
Freshmen	33	2.82	0.85	0.46	4.00
Sophomores	34	2.68	0.53	1.74	3.78
Juniors	17	2.72	0.29	1.95	3.18
Seniors	20	2.58	0.39	1.90	3.42
Hispanic					
Freshmen	44	2.52	0.94	0.00	3.70
Sophomores	30	2.73	0.52	1.60	3.72
Juniors	15	2.51	0.39	1.99	3.27
Seniors	11	2.75	0.43	2.08	3.38
Asian					
Freshmen	55	2.29	1.32	0.00	4.00
Sophomores	47	2.72	0.64	1.45	3.84
Juniors	23	2.72	0.37	1.99	3.48
Seniors	40	2.83	0.45	1.98	3.88
White					
Freshmen	55	2.29	1.33	0.00	4.00
Sophomores	36	2.84	0.54	1.45	3.85
Juniors	20	2.81	0.59	1.61	3.94
Seniors	62	3.00	0.54	1.95	3.99

Data Source: UMass Boston Registrar’s Office (May 2013), author’s tabulations

Table 6.c) Average Cumulative UMB GPAs for non-FSC transfer students by academic level

Race/ethnicity	# of observations	Mean	Std. Dev	Minimum	Maximum
Black/African American					
Freshmen	4	0.62	1.25	0.00	2.50
Sophomores	16	1.78	1.14	0.00	3.13
Juniors	14	1.97	0.99	0.00	3.20
Seniors	23	2.55	0.54	1.67	3.69
Hispanic					
Freshmen	1	2.10	1.05	2.10	2.10
Sophomores	5	2.05	0.99	1.05	3.63
Juniors	9	2.14	1.64	0.00	3.83
Seniors	10	2.69	0.39	2.21	3.43
Asian					
Freshmen	4	0.00	0.00	0.00	0.00
Sophomores	9	1.75	1.36	0.00	3.03
Juniors	27	1.89	1.30	0.00	3.83
Seniors	25	2.70	0.50	1.98	3.74
White					
Freshmen	8	1.42	1.52	0.00	3.91
Sophomores	40	2.41	1.37	0.00	4.00
Juniors	48	2.27	1.29	0.00	4.00
Seniors	72	2.96	0.83	0.00	4.00

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Table 7.a) Average Cumulative UMB GPAs **for *FSC students*** in May 2013 (by race/ethnicity)					
	URM students in FSC				
Race/ethnicity	# of observations	**Mean**	**Std. Dev**	**Minimum**	**Maximum**
Black	59	2.70	0.62	1.18	4.00
Hispanic	60	2.84	0.61	0.00	3.847
URM students	119	**2.77**			
	non-URM students in FSC				
White	143	2.96	0.71	0.00	4.00
Asian	90	3.01	0.63	1.43	4.00
non-URM students	233	**2.98**			
Difference		**0.21**			

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Table 7.b) Average Cumulative UMB GPAs for ***non- FSC incoming freshmen*** in May 2013 (by race/ethnicity)					
	URM non-FSC incoming freshmen				
Race/ethnicity	# of observations	**Mean**	**Std. Dev**	**Minimum**	**Maximum**
Black	104	2.71	0.60	0.46	4.00
Hispanic	100	2.61	0.72	0	3.72
URM students	204	**2.66**			
	non-URM non-FSC incoming freshmen				
White	173	2.72	0.92	0	4.00
Asian	165	2.61	0.89	0	4.00
non-URM students	338	**2.66**			
Difference		**0**			

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Table 7.c) Average Cumulative UMB GPAs for ***non-FSC transfer students*** in May 2013 (by race/ethnicity)					
	URM non-FSC transfer students				
Race/ethnicity	# of observations	**Mean**	**Std. Dev**	**Minimum**	**Maximum**
Black	57	2.06	1.02	0	3.69
Hispanic	25	2.34	1.09	0	3.83
URM students	82	**2.20**			
	non-URM non-FSC transfer students				
White	65	2.07	1.21	0	3.83
Asian	168	2.56	1.21	0	4.00
non-URM students	233	**2.31**			
Difference		**0.11**			

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Table 8) **A further analysis of differences** in GPAs						
	FSC Students		**non-FSC incoming freshmen**		**non-FSC transfer students**	
	White-Black	White-Hispanic	White-Black	White-Hispanic	White-Black	White-Hispanic
Seniors	0.22	-0.04	0.42	0.25	0.41	0.27
Juniors	0.20	0.34	0.09	0.30	0.30	0.13
Sophomores	0.52	-0.12	0.16	0.11	0.63	0.36
Freshmen	0.213	0.18	-0.53	-0.23	0.79	0.68
	Asian-Black	Asian-Hispanic	Asian-Black	Asian-Hispanic	Asian-Black	Asian-Hispanic
Seniors	0.15	-0.11	0.25	0.08	0.15	0.01
Juniors	0.18	0.32	0.11	0.32	0.73	0.56
Sophomores	0.72	0.08	0.15	0.10	0.92	0.65
Freshmen	0.44	0.39	-0.53	-0.23	0.62	-2.10

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Table 9.a) Average Cumulative UMB Credits for FSC students by academic level

Race/ethnicity	# of observations	Mean	Std. Dev	Minimum	Maximum
Black/African American					
Freshmen	27	15	1.797	12	18
Sophomores	10	39	5.711	29	47
Juniors	15	58	7.835	48	70
Seniors	7	99	12.63	82	121
Hispanic					
Freshmen	26	14	3.713	0	18
Sophomores	16	38	8.648	16	47
Juniors	11	61	5.849	50	70
Seniors	7	93	16.65	76	124
White					
Freshmen	53	15	4.2171	0	23
Sophomores	36	38	6.8832	25	47
Juniors	25	59	7.3371	48	71
Seniors	29	93	15.122	72	125
Asian					
Freshmen	38	16	2.8738	8	22
Sophomores	20	37	7.5977	24	47
Juniors	20	57	7.6784	48	71
Seniors	12	90	18.57	73	123

Data Source: UMass Boston Registrar’s Office (May 2013), author’s tabulations

Table 9.b) Average Cumulative UMB Credits for non-FSC incoming freshmen by academic level

Race/ethnicity	# of observations	Mean	Std. Dev	Minimum	Maximum
Black/African American					
Freshmen	33	12	4.29	3	22
Sophomores	34	35	6.33	24	45
Juniors	17	59	6.58	48	68
Seniors	20	99	16.96	73	122
Hispanic					
Freshmen	44	10	4.05	0	18
Sophomores	30	38	5.13	25	46
Juniors	15	57	6.78	48	70
Seniors	11	107	17.75	79	145
Asian					
Freshmen	55	10	6.36	0	23
Sophomores	47	35	6.60	24	47
Juniors	23	58	6.72	49	70
Seniors	40	105	22.35	73	146
White					
Freshmen	55	11	6.80	0	24
Sophomores	36	37	5.23	29	47
Juniors	20	63	6.49	48	73
Seniors	62	101	18.26	72	149

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations

Table 9.c) Average Cumulative UMB Credits for non-FSC transfer students by academic level

Race/ethnicity	# of observations	Mean	Std. Dev	Minimum	Maximum
Black/African American					
Freshmen	4	12	1.41	10	13
Sophomores	16	35	6.79	25	46
Juniors	14	57	7.07	48	68
Seniors	23	100	20.71	73	170
Hispanic					
Freshmen	1	22	5.54	22	22
Sophomores	5	34	6.34	28	43
Juniors	9	58	5.74	49	68
Seniors	10	99	14.92	77	116
Asian					
Freshmen	4	13	6.45	9	23
Sophomores	9	38	5.23	32	47
Juniors	27	61	7.17	48	71
Seniors	25	103	15.6	73	139
White					
Freshmen	8	17	3.99	10	22
Sophomores	40	37	6.03	24	47
Juniors	48	60	8.85	48	87
Seniors	72	99	20.22	72	184

Data Source: UMass Boston Registrar's Office (May 2013), author's tabulations