

University of West Georgia UWide Program Year 1 Evaluation (2011-2012)

This evaluation report describes results of University of West Georgia's (UWG) 2011-2012 UWide Program. The report includes findings from the 2011 Summer Bridge Program, comparisons of course grades between Bridge students and similar non-Bridge peers, and data on career interest and choice of major. Also included are five-year trends in STEM majors and STEM graduation.

2011 Summer Bridge Program

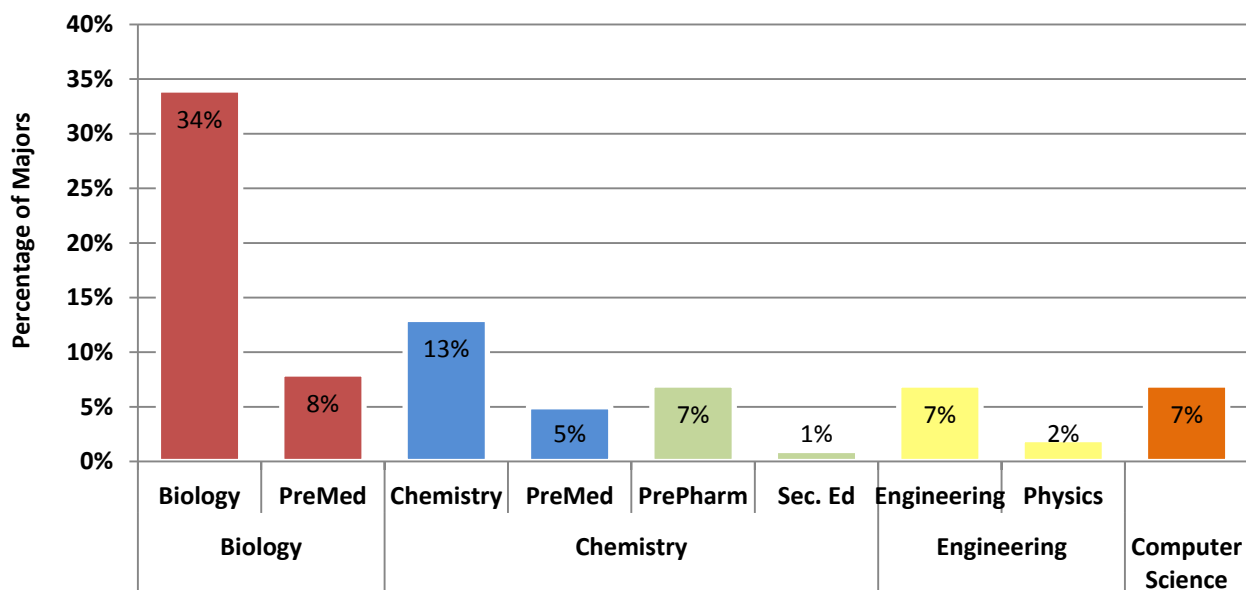
University of West Georgia's inaugural Summer Bridge Program took place in August 2011. One hundred one (101) students were invited to attend the 2-week program and 98 attended. Admission was open to incoming UWG freshman who were interested in majoring in a STEM discipline and who met minimum SAT score requirements. Students received 30 hours of instruction per week, participated in mandatory study halls, and attended evening lectures focused on STEM areas. Coursework included math, computer science, biology, chemistry, geosciences, and physics. All students chosen for the program received free housing and a meal plan. They were also eligible to receive a \$300 stipend for completing work to support the program evaluation. Students were required to enroll in *XIDS 2002: What Do You Really Know about STEM Professions and Teaching* for the Fall 2011 term.

Student Demographics. Summer Bridge participants included 57% females and 43% males. The majority of students were African-American (60%). Twenty-eight percent were Caucasian, 8% were mixed race, and 3% were Hispanic. Students' average high school GPA was 3.06, and their average total SAT score was 1454. Averages on subtests were 493 in critical reasoning, 494 in math, and 461 in writing. Additional data are provided later in this report in Table 2.

Student Evaluation of Summer Bridge

Of the 98 students who participated in the 2011 Summer Bridge Program, 89 students completed the post survey at the end of their two-week program (9 skipped large portions of the survey, and their responses are not provided here). On the survey, they rated the courses they took, program activities, and logistics (dorms, food), and they also provided information about their intended major, whether their interest in being a STEM major had changed, and whether they were interested in receiving tutoring in math, science, or English during the Fall semester. Although there were no data collected at the beginning of the program about students' intended majors, students were asked to provide this information on the post survey. Most students chose a biology or chemistry major. Percentages of students in each major are provided in Figure 1. Not included are geology, environmental science, nursing, geography, and majors that were chosen by fewer than two students each.

Figure 1. Students' Intended Major at the End of Summer Bridge



Course Experiences. Students were asked to rate their course experiences on a 1 (*worst*) to 5 (*best*) scale. Descriptive statistics for each course are presented in Table 1. As illustrated, biology, a field with the largest number of intended majors, was the course that received the lowest rating (3.11) from students. Chemistry, a field that also had a large number of intended majors, received the third highest course rating (3.98). The course that received the highest overall course rating from students (4.16) was computer science.

Table 1. Summer Bridge Course Ratings

Course	Course Rating	
	Mean	SD
Biology	3.11	1.15
Physics	3.48	1.10
Geosciences	3.58	1.15
Math	3.61	1.05
Math-Statistics	3.64	1.18
Chemistry	3.98	1.03
Math-Problem Solving	4.06	0.96
Computer Science	4.16	1.03

Course ratings were compared for students in each of the four Bridge cohort groups (Green, Red, Yellow, and Blue). Though there were no statistically significant differences, there was a large effect size difference in Biology, with students in the Green (Mean biology rating: 2.67) and Yellow (2.95) groups rating the course much lower than students in the Red (3.32) and Blue

(3.45) groups. The standardized effect size difference between the Green and Blue groups was 0.65, indicating more than half a standard deviation difference between the groups' ratings.

The most frequent survey comments about the biology class came from the Green group, with over half of the group providing responses. Most comments related to the course focusing too much on graphing and not enough on biology. Comments included, "*There was little biology taught,*" "*Needs less math and more science,*" "*Should learn biology, not how to graph,*" and "*Would have rather liked to learn about biology.*" Similar comments were made by students in other groups but with much less frequency. In other groups, students also requested more lab work in biology and less lecture time. During group interviews, some students commented about the number of worksheets given in the biology course and the lack of hands-on activities. One student said, "*We were told not to wear open-toed shoes, then we didn't do anything.*"

When asked about coursework during the group interviews, students suggested that concepts taught in the courses should build on each other. One student explained, "*Instead of changing subjects every single day in math, do one subject for the entire week, then another the next week. One day was exponents, the next sine and cosine, and it doesn't build on each other.*" Another commented,

We'd learn something and be tested on it the next day. The two weeks were broken up into Week 1 and Week 2. It would have been different if they would have taken one thing and expanded on it rather than [cover] a random collection of topics. Focus on something and build up.

In response, another student said, "*A lot of the math, in my opinion, was built up. The rest of it should have been. Biology had almost nothing to do with biology.*"

Summer Bridge Activities and Support. Students rated Summer Bridge activities and support on a 1 (*worst*) to 5 (*best*) scale. They gave high ratings to the Summer Bridge student assistants ($\bar{x} = 4.3$). Ratings were moderate for the evening program lectures (3.30) and the evening homework assignments (3.43). Ten students who wrote comments about the student assistants (SA) said they were very helpful, although there were a few comments about one particular SA who was rude and impatient with students. Positive comments included, "*They were great,*" "*Good at explaining,*" "*Very helpful,*" and "*Down to earth and willing to help.*" In group interviews, students made a number of positive comments about the SAs and how helpful they were. Students also commented about the helpfulness of the EXCEL Center staff and the professors. Another student explained that the EXCEL Center staff provided information on ways to study, time management, scheduling classes, tutoring, and mentoring. Other students commented on assistance they received from faculty. In particular, one student stated,

The professors really take the time out to make sure you understand what they are teaching. It's really different from high school where the teacher gives out work and some people do it. Here, they give you the work and go over it and make sure you understand it and encourage you to ask questions.

On surveys, only a few students wrote about the homework assignments, though those who did commented that there were too many assignments or the work was too long. As one student explained, the homeworks were *“Too close together and back to back. Hard to remember that amount of information.”* Another student, however, wrote the homeworks *“Simulated [the] workload of college well,”* and another wrote that it was *“Challenging.”* In group interviews, some students made comments about study hall (where students completed evening homework). One student said, *“I didn’t like the study hall they forced us in. I hated staying there for 1 ½ hours with nothing to do.”* Another student commented, *“In study hall, if you finish your work you have to stay there anyway.”* Another student suggested changing the requirement, explaining, *“Make the first hour mandatory and the second optional so that you can stay if you want or you can go home and study in a quieter environment.”*

Several students commented about the evening lectures, and the most frequent response was that the lecture on alcohol awareness and public safety was preferred over other lectures. As one student explained, *“I would give a 3 to all [lectures] except the lecture about alcohol awareness; it was a 5.”* A few other students wrote that the lectures were too long or were on boring topics. One student suggested adding a lecture focused on *“How Should I Study for College.”* Another asked for more information on alcohol, sex, and safety.

Need for Additional Support. When asked at the end of the Summer Bridge Program if they would be interested in tutoring in math, science, or English during the Fall 2011 semester, large percentages of participants said they were interested, particularly in math and science. Percentages in each area were:

- Math: 83% of students were interested in tutoring
- English: 49% of students were interested in tutoring
- Science: 62% of students were interested in tutoring
 - 52% were interested in Chemistry tutoring
 - 23% were interested in Biology tutoring
 - 11% were interested in Physics tutoring

Changes in STEM Interest. At the conclusion of Summer Bridge, over half of participants said their interest in being a STEM major had not changed. Just over 11% said their interest had decreased, and 6 students provided written responses to explain the decrease. Four of these students were less interested because of the difficulty of the work. As one student explained, *“It showed me how hard I have to work and it worries me because my high school did not prepare me.”* Another student wrote *“Not a good chance I will make it.”* Another student indicated that his or her chosen major might not be what they were interested in studying in college.

Over a third of students (34%) said their interest in being a STEM major had increased during Bridge. Although the difficulty of the work is what discouraged students whose interest in majoring in STEM had decreased, the difficulty and challenge is also what increased other students’ interest. In fact, seven students responded that the challenging nature of the work

increased their interest. As one student explained, *“I have a hard trip ahead of me, but that’s what makes it worthwhile.”* Another wrote, *“I feel that it will be challenging,”* and a third responded, *“It has stimulated me to push and try better.”*

Students’ Overall Experience in Summer Bridge. When asked for their comments about their overall experience in Summer Bridge, 41 students provided positive responses, and 15 provided negative responses (a few of these students provided both positive and negative responses). Twelve of the 15 negative responses focused on a logistical aspect of the program, such as the daily schedule, the way notebooks were organized, or the need for more supervision in the dorms. Two students provided feedback about the workload—one student wrote that it was not mentally challenging, and the other had the opposite experience, explaining, *“I found it way too difficult to learn new material in a single day and then have a midterm/final all in only 2 weeks.”* Another student commented about lack of variety in the coursework. The student wrote, *“Would have preferred more inter-professor communication. Several gave almost identical lessons on conversion, geography, etc. More varied lessons always a plus.”*

In group interviews, a few students suggested setting up the Bridge class schedule more like a traditional college schedule rather than a high school schedule. As one student commented,

Sometimes it’s kind of boring because it’s just lectures starting early in the morning throughout the day, like high school with classes fast-paced and back-to-back. It’s tiring. It makes us feel like we are in high school, and we know that our schedules will not be like that [in college], so some of us are confused, and that’s what bores us.

Another student suggested making the schedule more like a traditional college schedule based on major and career goals and giving students options about what courses to take.

Of the 41 positive responses about the program, several were general (e.g., *“Great experience”*), but some students provided information that is more specific. Fifteen students commented that Summer Bridge helped prepare them for college. As one student explained,

My overall experience was life changing and it gave me a [sense] of how to handle my college schedule when the time comes. It also prepared [me] for college and showed me that college is a huge step from high school and you really have to work hard to get what you want.

Four students wrote that the Bridge program served as a refresher course that was useful for preparing them for college. For example, one student responded, *“Even though my overall grade for my midterm wasn’t good I still feel like this program was beneficial to me. It was a good refresher and good insight.”* In group interviews, students also frequently commented on the usefulness of the program as a refresher course. A student stated, *“A lot of stuff being reviewed I did not remember from high school, and it refreshed my memory, so I’ll be better prepared in the Fall.”*

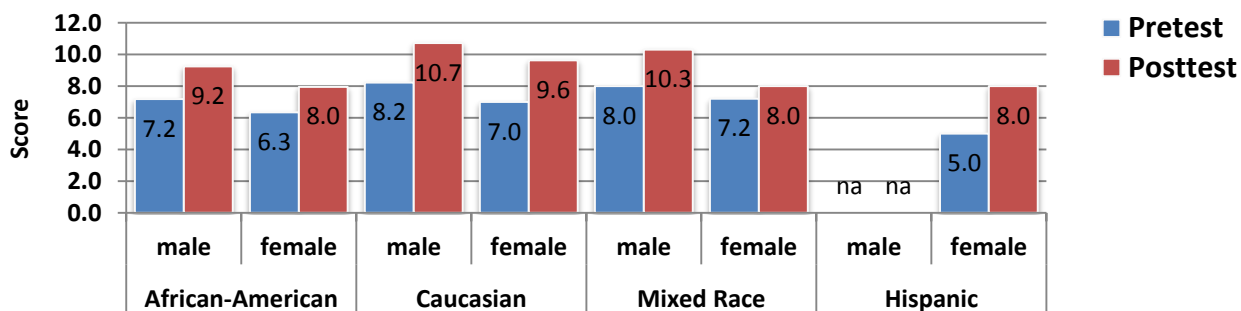
Positive comments also included responses about the effort and hard work required in college. One student wrote, *“Summer Bridge Program taught that effort can make things possible.”* Another indicated he/she was considering changing majors (from biology to chemistry) because of experiences in the Bridge program. In describing this, the student wrote, *“I realized it will take hard work and dedication to succeed.”* Another student was appreciative of learning about his/her strengths and weakness in different subject areas.

A number of students were grateful for the opportunity to participate in the Bridge program. As one student expressed, *“Thank you for this opportunity. I really appreciate it because opportunities like these do not come, especially for free.”* Another wrote, *“Thank you so much for this wonderful experience. I had a great time and I learned a lot. Keep the program going. I think it would benefit a lot of students.”* Another student suggested keeping the group together. The student commented, *“I think you should keep this program running and keep us all together for a while, maybe even turn it into some kind of academic club.”*

Pre/Post Math Test Results. Summer Bridge students were given a math pre- and post-test at the beginning and end of the summer program. The pre- and post-tests contained the same 14 items, which measured algebra, geometry, and statistics problem-solving. All questions were multiple choice with four response choices. Students were given 15 minutes to complete the test at each administration. Students took the tests during the math portions of their Bridge program, which resulted in some students taking the tests in the morning and others taking it in the afternoon. The pretest is provided in Appendix 1.

Students’ mean pretest score was 6.97 (out of 14), and their mean posttest score was 8.93. This 2-point difference was statistically significant ($t_{98} = 7.802, p = .000$). Comparisons also were made by race and gender. On both the pre and posttests, males outperformed females, and Caucasian students outperformed their non-white peers; however, each group showed improvement between the pre and posttests (see Figure 2). Hispanic females demonstrated the most growth, though because of the small group size ($n=3$), caution in interpretation is warranted. Caucasian students, both male and female, had posttest scores roughly 2½ points higher than their pretest scores. Changes were smallest for African-American and mixed race females.

Figure 2. Pre/Post Math Test Comparisons by Race and Gender (Highest Possible Score = 14)



Comparisons of Bridge Students to STEM-major Peers

This section provides analysis of Summer Bridge students' grades for the Fall 2011 and Spring 2012 semesters in these courses:

ENGL 1101: English Composition I

MATH 1111: College Algebra

MATH 1113: Pre Calculus

MATH 1634: Calculus I

CHEM 1212: Principles of Chemistry

PHYS 1111: Introductory Physics I

BIOL 1107: Principles of Biology I

BIOL 1108: Principles of Biology II

XIDS 2002: What Do You Know About STEM Professions and Teaching?

Comparisons are made to Bridge students' non-Bridge peers who were freshman in their first semester in college and who had declared a STEM major. In the comparison group, we excluded students whose SAT scores fell outside the range of Bridge students' scores; thus, students in the comparison group had to have between a 400 and 660 on the SAT critical writing test, between a 410 and 670 on the SAT math test, and between a 330 and 590 on the writing test (**Note:** there was one Bridge student with a 740 on the math section and another with a 240 on the writing section, but we disregarded those outliers when determining our comparison ranges).

Student Demographics. Of the 98 students who took part in UWG's 2011 Summer Bridge Program, 42.6% were male and 57.4% were female. Sixty percent were African-American, 27.8% were Caucasian, 9.3% were multiracial, and the remaining students listed no race. Of those students, 95% were still enrolled in the Spring 2012 term. The average Fall 2011 GPA of students who did not return in the Spring term was 1.49. The average GPA for returning students was 2.39. Spring GPA was slightly higher at 2.45. Table 2 provides additional information on Summer Bridge students' SAT scores, high school GPA, and STEM course grades during students' freshman year.

As indicated, although Caucasian students had much higher admissions SAT scores and high school GPAs, African-American students outperformed them in English, math, chemistry, physics, and the XIDS course. Course grades were also higher for African-Americans in BIOL 1107, but it was lower for BIOL 1108. Males had higher admissions SAT scores than females, and their course grades were higher in all compared courses except ENGL 1101 and MATH 1113. Males' overall semester GPA was higher than female students'.

Table 2. 2011 Summer Bridge Students' Admissions and Freshman Year Data

		Race		Gender		Total
		African-American	Caucasian	Male	Female	
Admissions	SAT-Critical Reasoning	472	528	512	479	493
	SAT-Math	475	540	529	476	494
	SAT-Writing	450	479	461	460	461
	SAT-Total	1396	1547	1503	1415	1454
	High School GPA	2.94	3.26	3.05	3.07	3.06
Freshman Year (Mean GPA)	ENGL 1101	1.81	1.44	1.61	1.76	1.75
	MATH 1111	2.31	1.55	2.29	2.15	2.20
	MATH 1113	2.50	2.42	2.29	2.78	2.51
	MATH 1634	2.56	1.63	2.36	1.67	2.18
	CHEM 1212	2.78	1.00	2.88	2.57	2.65
	PHYS 1111	2.60	2.22	2.64	1.80	2.42
	BIOL 1107	3.25	2.33	3.33	2.33	2.86
	BIOL 1108	1.50	3.75	2.83	2.67	2.78
	XIDS 2002	2.78	2.35	2.82	2.60	2.69
	Fall 2011 GPA	2.32	2.20	2.39	2.28	2.33
	Spring 2012 GPA	2.45	2.13	2.41	2.38	2.39

When comparing admissions statistics between Bridge and non-Bridge students, Bridge students had slightly lower SAT scores in critical reasoning, math, and in writing (see Table 3). Bridge students' high school GPA (3.06) was also lower than their non-Bridge counterparts' GPA (3.14). Bridge students' Fall 2011 GPA (2.33) was a bit lower than non-Bridge students' GPA (2.47).

When comparing grades for freshman year courses, Bridge students outperformed non-Bridge students in MATH 1634, CHEM 1212, BIOL 1107, BIOL 1108, and BIOL 2107. Non-Bridge students outperformed Bridge students in ENGL 1101, MATH 1111, MATH 1113, PHYS 1111, and XIDS 2002; however, in MATH 1111, Bridge and non-Bridge students had the same percentage of students who earned a grade of D, F, or W (withdrew), and in PHYS 1111, the percentage of Bridge students with a D/F/W grades was actually lower than that of non-Bridge peers (see Table 3), even though GPAs were higher for non-Bridge students in these courses.

Table 3. Bridge Students and Non-Bridge Peers: Admissions and Freshman Year Grades

		Summer Bridge Students	Non-Summer Bridge Students	Bridge Students D/F/W	Non-Bridge Students D/F/W
		Mean	Mean	%	%
Admissions	SAT-Critical Reasoning	493	494		
	SAT-Math	494	502		
	SAT-Writing	461	466		
	High School GPA	3.06	3.14		
Freshman Year (Mean GPA)	ENGL 1101	1.73	2.08	43%	33%
	MATH 1111	2.34	2.41	28%	28%
	MATH 1113	2.38	2.49	29%	26%
	MATH 1634	2.18	1.91	38%	45%
	CHEM 1212	2.65	2.33	19%	35%
	PHYS 1111	2.42	2.52	25%	29%
	BIOL 1107	2.86	2.55	25%	30%
	BIOL 1108	2.78	2.10	30%	36%
	BIOL 2107	2.33	2.30	33%	25%
	XIDS 2002	2.69	3.50	14%	8%
	Fall 2011 GPA	2.33	2.47		
	Spring 2012 GPA	2.39	2.40		

Changes in Choice of College Major. At the end of the Spring 2012 semester, data were analyzed from all Fall 2011 entering UWG freshman who declared a major in a STEM field their first semester in college. Of these students, 105 were Bridge students (3 Bridge students were undeclared), and 584 were non-Bridge students. The majority of Bridge students declared official majors in a STEM field. Comparisons of major between Bridge and non-Bridge STEM majors are provided in Table 4.

Table 4. Comparisons of Major between Bridge Students and Non-Bridge STEM Majors

Major	Percentage of Majors	
	Bridge	Non-Bridge
Biology	40.0%	55.3%
Chemistry	21.8%	10.3%
Computer Science	4.8%	14.3%
Engineering	14.3%	6.5%
Geology	1.9%	1.4%
Physics	--	1.4%
Secondary Education (STEM)	1.9%	1.2%
Total Number	98	584

Other declared majors for Bridge students were environmental science, geography, nursing, management information systems, psychology, mass communication, and sport management.

During the Spring 2012 term, 15 Bridge students (13.9%) and 69 non-Bridge STEM majors (11.8%) changed their majors. Seven Bridge students (6.5%) changed from a STEM major to a non-STEM major, and 43 non-Bridge STEM majors (7.4%) changed to a non-STEM major. For both Bridge and non-Bridge students, the most frequent switch was to business or nursing. For Bridge students who changed to a non-STEM major, 57.1% changed to a business field and 28.6% changed to nursing. Among non-Bridge students, 37.2% changed to business, 23.2% changed to nursing, and 25.6% became undeclared majors.

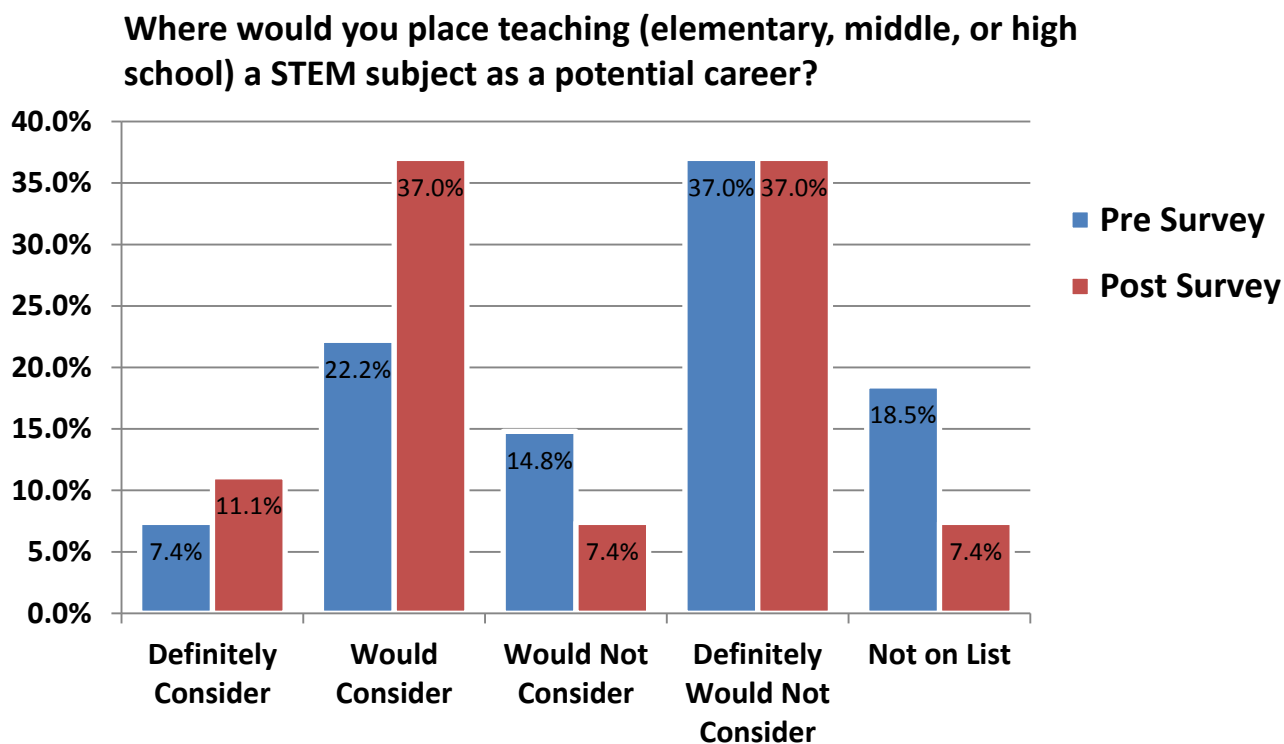
Career Awareness/Knowledge Survey. Seventy-six Summer Bridge students who enrolled in the XIDS 2002 course completed the Career Awareness survey, including 45 females (59%) and 30 males (39%). One individual did not list a gender. Students were mostly African-American (47%) and Caucasian (30%). There were also 5% Hispanic, 12% multi-racial, and 4% other race students. All but one student knew that STEM referred to science, technology, engineering, and mathematics. Students were unfamiliar with some of the fields listed on the career survey and which broader fields they were related to. They were most familiar with careers in technology fields and least familiar with careers in engineering and physics.

When asked on the pre-survey what career they planned to pursue, 44% chose a field in a medical-related field (e.g., physician, surgeon, nurse, physical therapist, dentist) and 14% listed pharmacy. Approximately 17% of students listed a STEM career in areas such as chemical engineer, biochemist, software engineer, or mathematician. A large percentage of students (66%) reported they had not considered a career in teaching, and about 26% said they would consider or definitely consider teaching.

Thirty-two (32) Bridge students completed the XIDS 2002 post survey at the end of the semester. We compared these students' post survey responses with their pre survey responses. Of these students, 68% said on the pretest they had not considered teaching as a career option, but by the end of the course, the percentage had decreased to 47%. As indicated in Figure 3,

higher percentages of students said on the post test that they would consider teaching in a K-12 STEM field, with percentages of students saying they would definitely consider teaching increasing from 7.4% to 11.1%, and percentages of students saying they would consider teaching increasing from 22.2% to 37%. The percentage of students who said they would not consider K-12 STEM teaching decreased from 14.8% on the pre survey to 7.4% on the post survey (see Figure 3). **[Note:** Only students who provided pre and post survey responses to this item were included in the analysis (n = 27)

Figure 3. Summer Bridge Students' Pre-Post Interest in K-12 STEM Teaching



Five-Year Trends in STEM Majors and Degrees Conferred

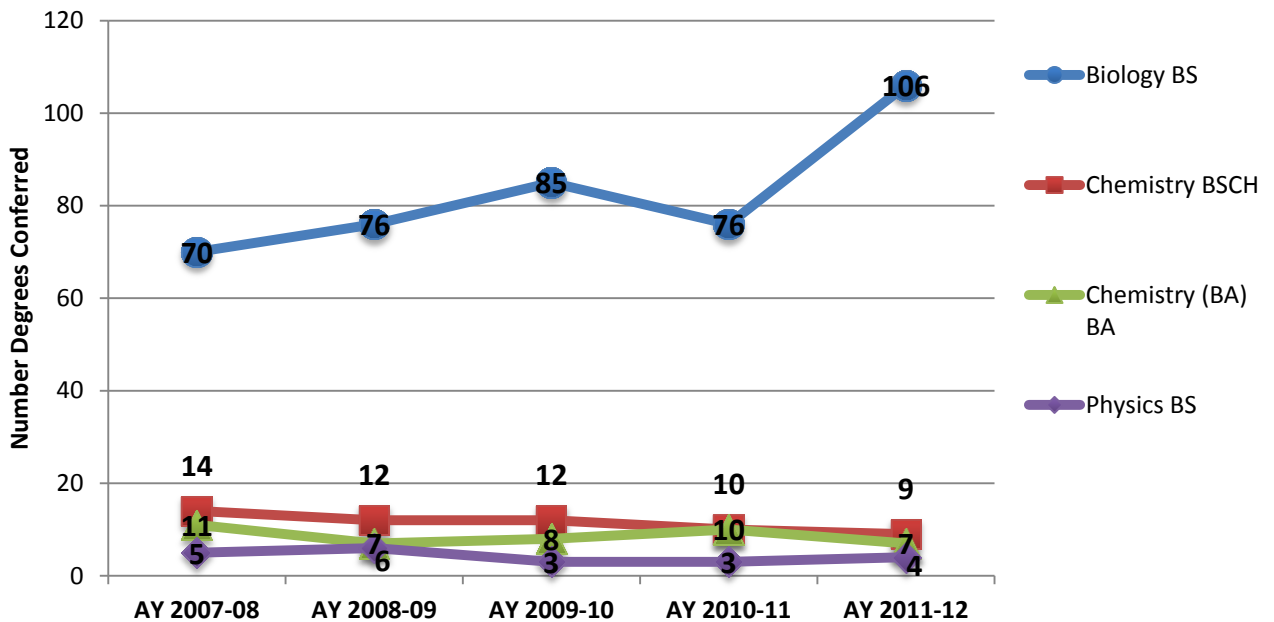
Numbers of students declaring STEM majors, as well as numbers of STEM degrees conferred, were reviewed from FY 2007 through FY 2012. It should be noted that during this same time period, undergraduate enrollment increased 13.8%, from 8,675 students in AY2007-2008 to 9,875 in AY2011-2012. The purpose here is to describe the institutional context and history for STEM majors and degrees, which will allow UWG to determine rates of growth in future years. In FY2012, UWG graduated 197 STEM majors. Over half were biology majors, 14% were STEM education majors, and 8% were computer science majors. Table 5 provides numbers and percentages of degrees conferred in each STEM area, with comparisons by gender. As indicated, females outnumbered males in biology, chemistry (BA only), and in STEM education degrees.

Table 5. University of West Georgia STEM Degrees Conferred FY2012

Degree	Major	Total	Females	Males
BA	Chemistry	7 3.6%	5 71.4%	2 28.6%
BSCH	Chemistry	9 4.6%	2 22.2%	7 87.8%
	Chemistry/Dual Degree Engineer	3 1.5%	2 66.7%	1 33.3%
BS	Biology	106 53.8%	72 67.9%	34 32.1%
	Computer Science	16 8.1%	3 18.8%	13 81.2%
	Environmental Studies	4 2.0%	1 25%	3 75%
	Environmental Science	4 2.0%	1 25%	3 75%
	Geology	11 5.6%	5 45.4%	6 54.6%
	Mathematics	5 2.5%	1 20%	4 80%
	Physics	4 2.0%	0	4 100%
BS	Biology/Secondary Education	6 3.0%	6 100%	0
	Earth Science/Secondary Education	3 1.5%	2 66.7%	1 33.3%
	Mathematics/Secondary Education	9 4.6%	3 33.3%	6 67.7%
BSED	Middle Grades Education - Math/Science	10 5.1%	5 50%	5 50%
Total		197	108	89

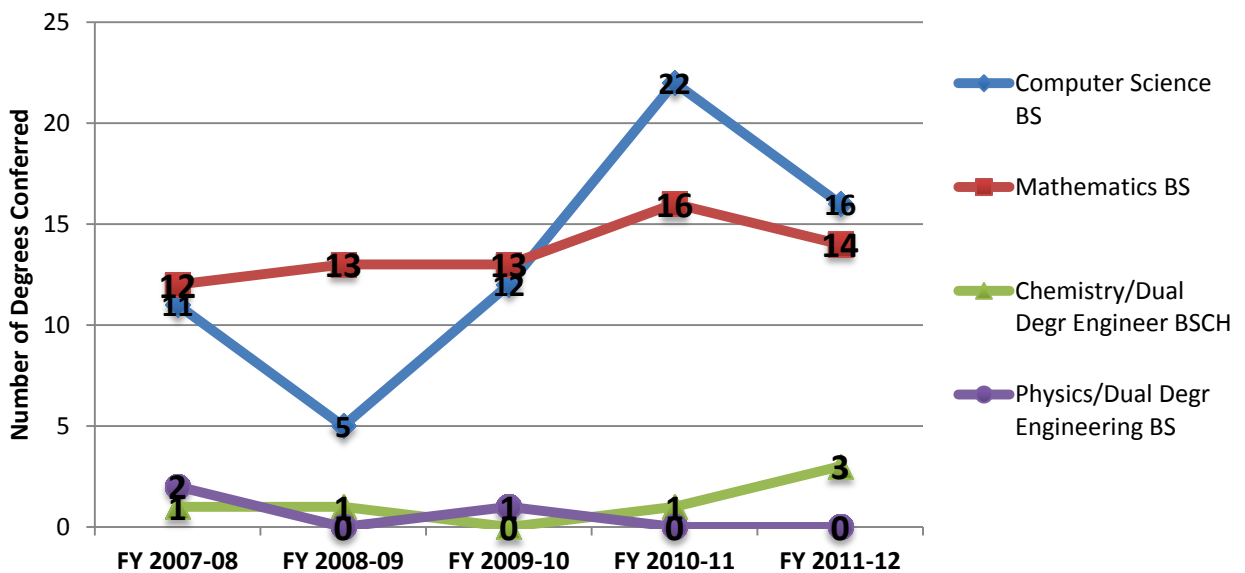
When looking at number of STEM degrees conferred between AY2007-2008 and AY2011-2012, increases were found in biology, computer science, mathematics, chemistry/engineering, environmental science, and several STEM education fields. As illustrated in Figure 4, which shows number of degrees conferred between 2008 and 2012 in biology, chemistry, and physics, the only increase was in biology. In AY2007-2008, there were 70 Biology BS degrees conferred, which increased by 51% to 106 in AY2011-2012. Number of BSCH and BA degrees in chemistry decreased by 35.7% and 36.3%, respectively.

Figure 4. Degrees Conferred 2008-2012 in Biology, Chemistry, and Physics



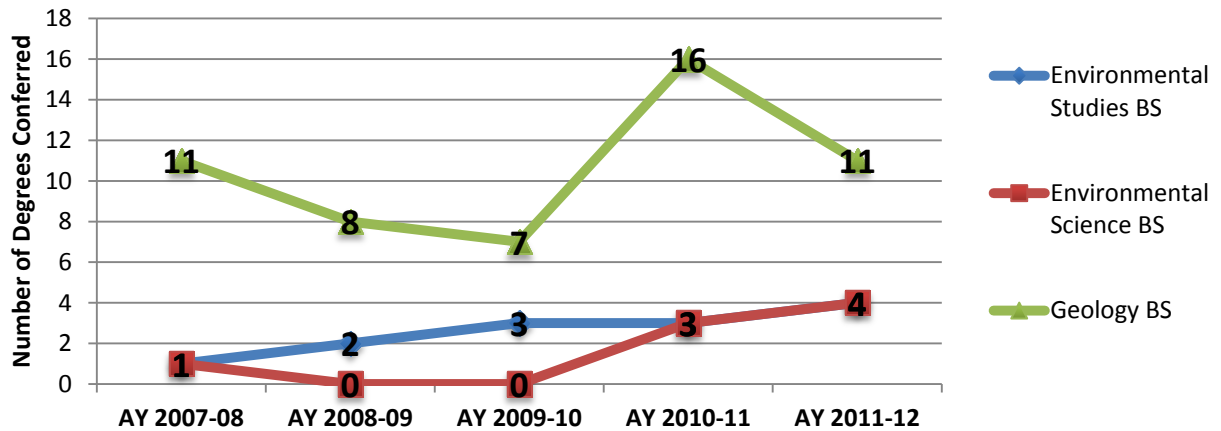
Between AY2007-2008 and AY2011-2012, number of degrees conferred increased in computer science (from 11 to 16, a 45.5% increase) and mathematics (from 12 to 14, a 16.7% increase). In engineering fields, physics/engineering degrees dropped from 2 to 0, while chemistry/engineering degrees increased from 1 to 3 (see Figure 5).

Figure 5. Degrees Conferred 2008-2012 in Computer Science, Mathematics, & Engineering



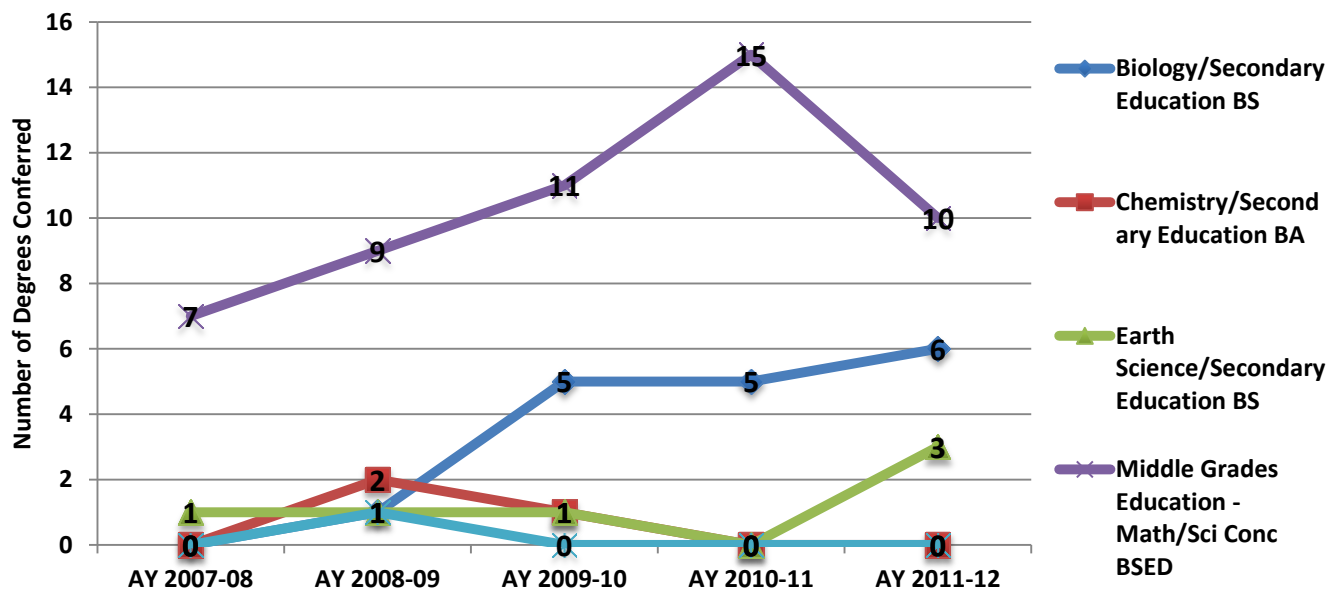
Geology degrees fluctuated over the 5-year period, starting with 11 degrees conferred in AY2007-2008, dropping to a low of 7 in 2009-2010, hitting a high of 16 in 2010-2011, and then dropping back down to 11 last year (see Figure 6). There was a steady increase in degrees in environmental science and environmental studies, though degrees conferred remain low.

Figure 6. Degrees Conferred 2008-2012 in Environmental Science/Studies and Geology



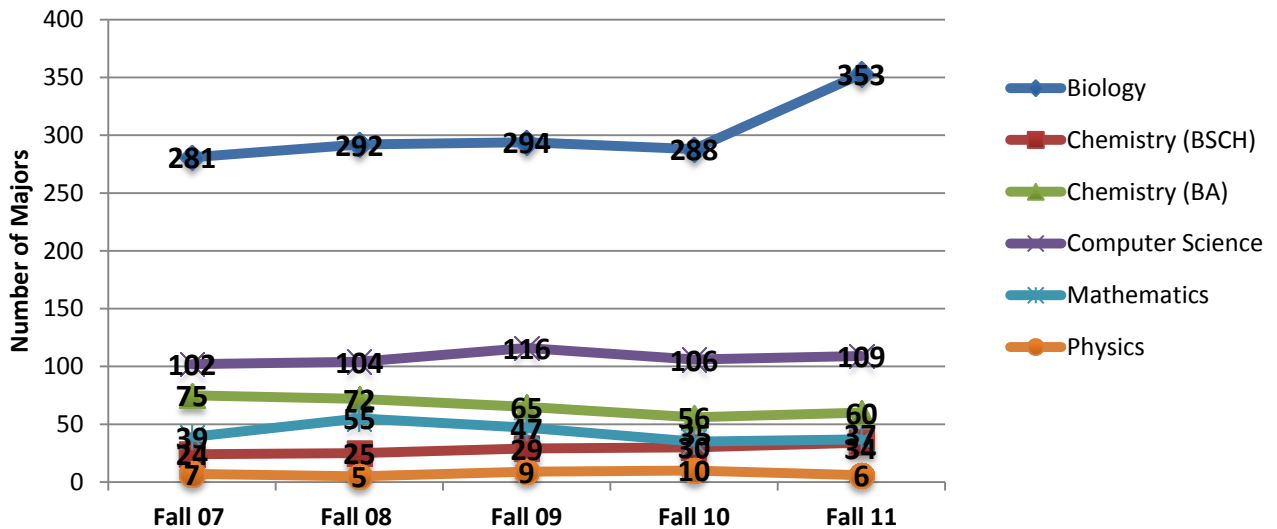
In STEM education fields, the greatest area of increase for number of degrees conferred between AY2007-2008 and AY2011-2012 was in Biology/Secondary education, which had no degrees conferred the first year and 6 degrees conferred this past year. Middle grades education—Math/Science concentration degrees increased by 43%, and Earth science/Secondary degrees increased from 1 to 3 (see Figure 7).

Figure 7. Degrees Conferred 2008-2012 in STEM Education Fields



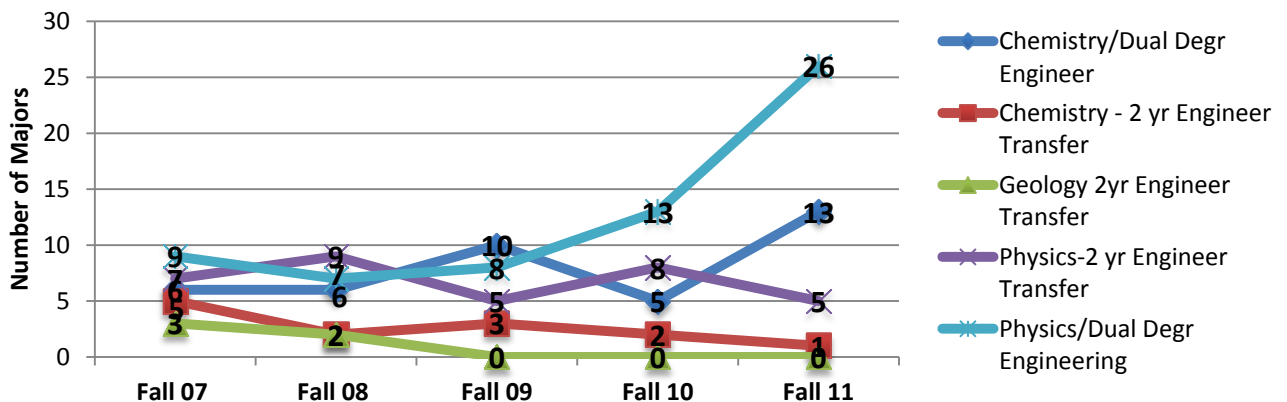
Five-Year Comparisons of Number of STEM Majors. When reviewing data from FY2007 through FY 2012 for majors in biology, chemistry, physics, computer science, and math, the major with the highest increase is biology (see Figure 8). In Fall 2007, 281 freshman declared biology as their major, and numbers increased slightly through 2010. In 2011, however, 353 freshman declared biology as their major, a 25.6% increase over the five year span. Computer science majors increased by almost 7% in the same timeframe. BS majors in chemistry (BSCH) increased by 42% while BA degrees in chemistry decreased by 20%. There was little change in numbers of physics and mathematics majors between Fall 2007 and Fall 2011.

Figure 8. Fall Freshman Majors by Year: Biology, Chemistry, Computer Science, Math, Physics



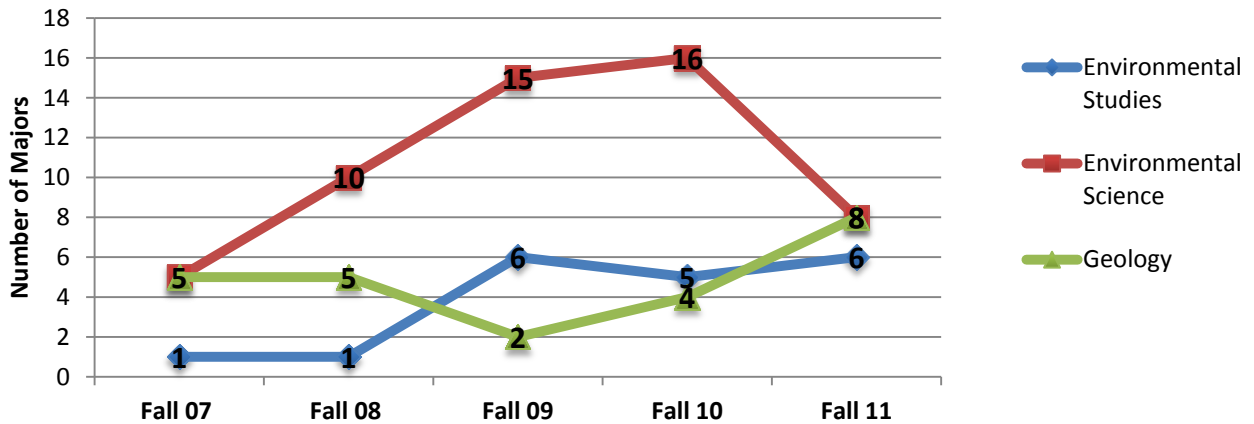
When comparing numbers of freshman majors in different engineering programs, increases were found only in Physics/dual degree engineering, which increased by 188% percent, and Chemistry/dual degree engineering, which increased by 116%. Numbers of majors are still relatively small, with 26 freshman physics/engineering majors and 13 freshman chemistry/engineering majors in 2011. As illustrated in Figure 9, numbers of majors decreased in Chemistry/2-year engineering transfers (-80%), Geology/2-year engineering transfers (-100%), and Physics/2-year engineering transfers (-28.6%).

Figure 9. Fall Freshman Majors by Year for Engineering Programs



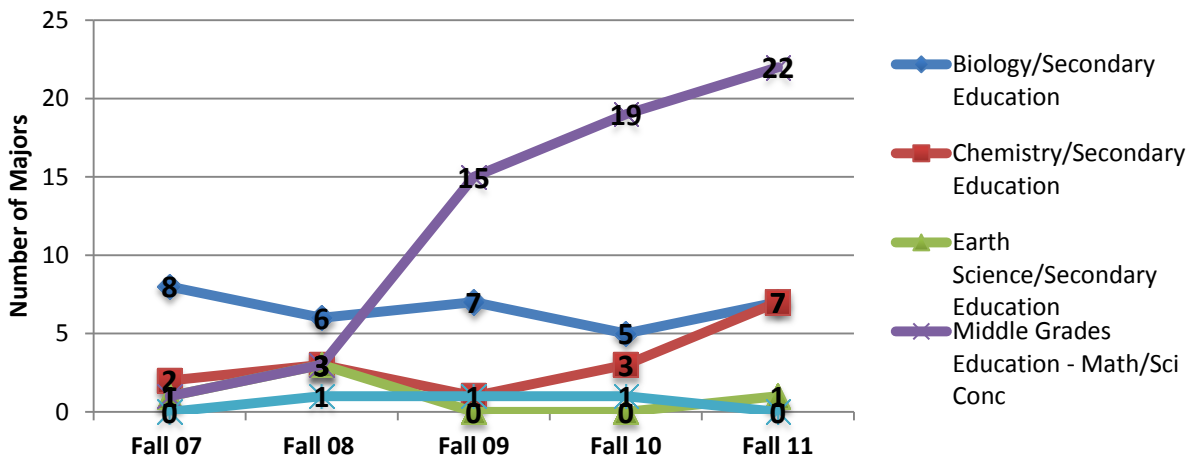
Though programs in environmental studies/science and geology have had few freshman-declared majors in the last five years, number of majors has increased, as shown in Figure 10. Between Fall 2007 and Fall 2010, there was a 220% increase in the number of environmental science majors; however, number of majors fell drastically in Fall 2011, resulting in an overall 5-year increase of 60%. Geology majors also increased by 60%, and environmental studies majors increased by 500%, from 1 freshman major in 2007 to 6 freshman majors in 2011.

Figure 10. Fall Freshman Majors by Year for Environmental Science/Studies & Geology



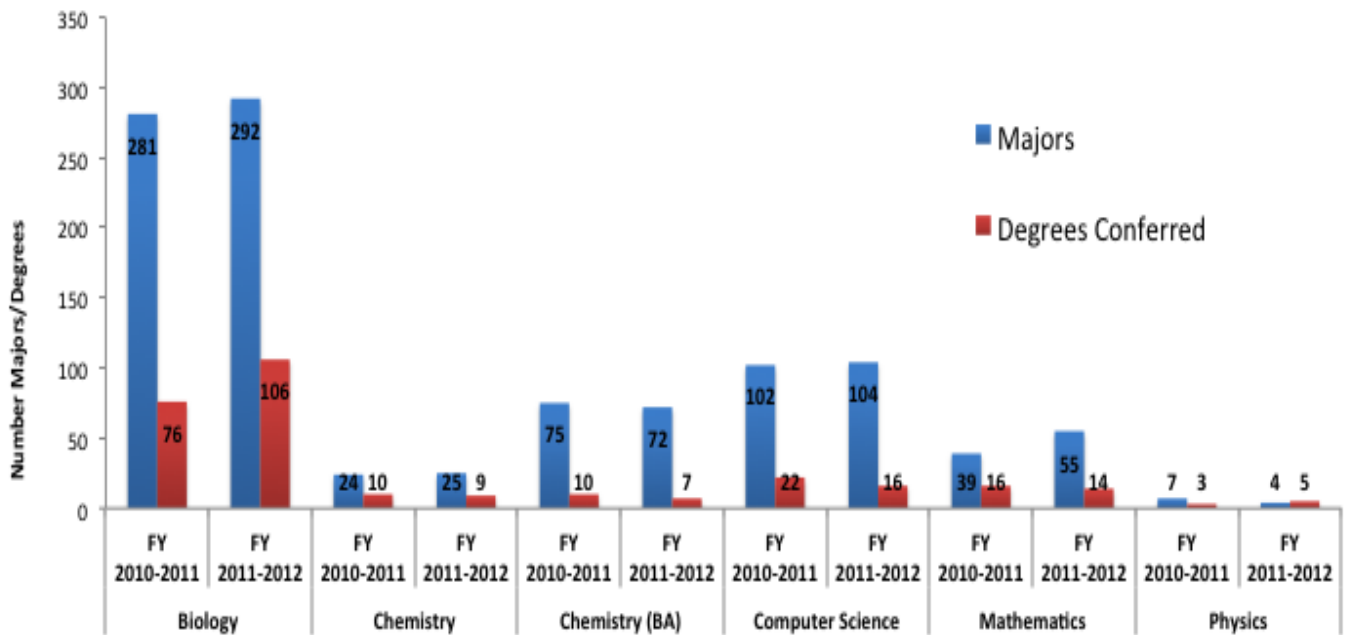
When comparing freshman STEM teaching majors in secondary education, most programs had very little change between 2007 and 2011. In fact, there was no change in number of Earth science/Secondary education majors (n=1) except for a slight increase during 2008 and 2009, and there were zero Physics/Secondary education majors except between 2008 and 2010. However, in Chemistry/Secondary education, majors increased from 2 in 2007 to 7 in 2011, a 250% increase. There was a large increase in Middle grade education majors (math/science concentration), though it is unclear whether this increase was the result of a shift in the way major codes were used or if it represents growth in the program (see Figure 11).

Figure 11. Fall Freshman Majors by Year for STEM Education Fields



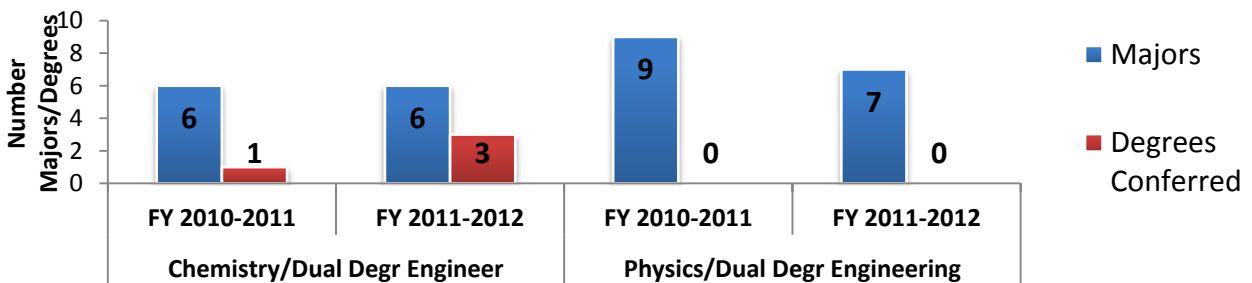
STEM Majors and Degrees Conferred for the Classes of 2011 and 2012. When comparing the number of Freshman who declare a STEM major and the number who graduate with that major 4 years later, there are significant decreases in most STEM areas. Figure 11 provides data on the graduating classes of 2011 (freshman in 2007) and 2012 (freshman in 2008) and shows the number of freshman majors in blue and the number of degrees actually conferred for that class four years later (in red). Thus, although 281 freshman declared Biology as their major in 2007, there were only 76 biology degrees conferred four years later.

Figure 11. Comparisons of Majors to Degrees Conferred, Classes of 2011 & 2012: Biology, Chemistry, Computer Science, Math, and Physics



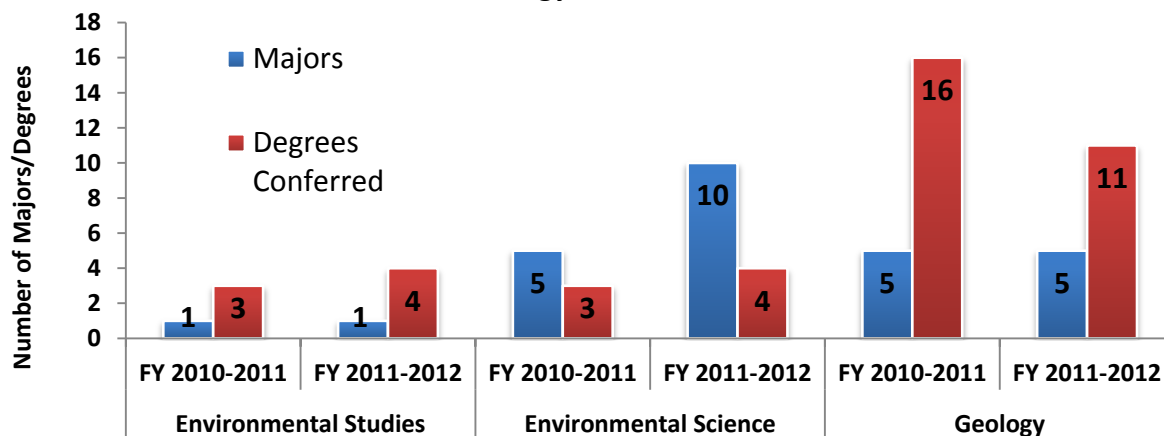
Similar trends were found with engineering majors. As indicated in Figure 12, though there were 6 declared Chemistry/dual degree engineering majors for Freshman who entered in 2007 and 2008, there was only 1 graduate in 2011 and 3 in 2012. There were no Physics/dual degree engineering majors in either of those years, though there were freshman who declared the major 4 years earlier.

Figure 12. Comparisons of Engineering Majors to Degrees Conferred, Classes of 2011 & 2012



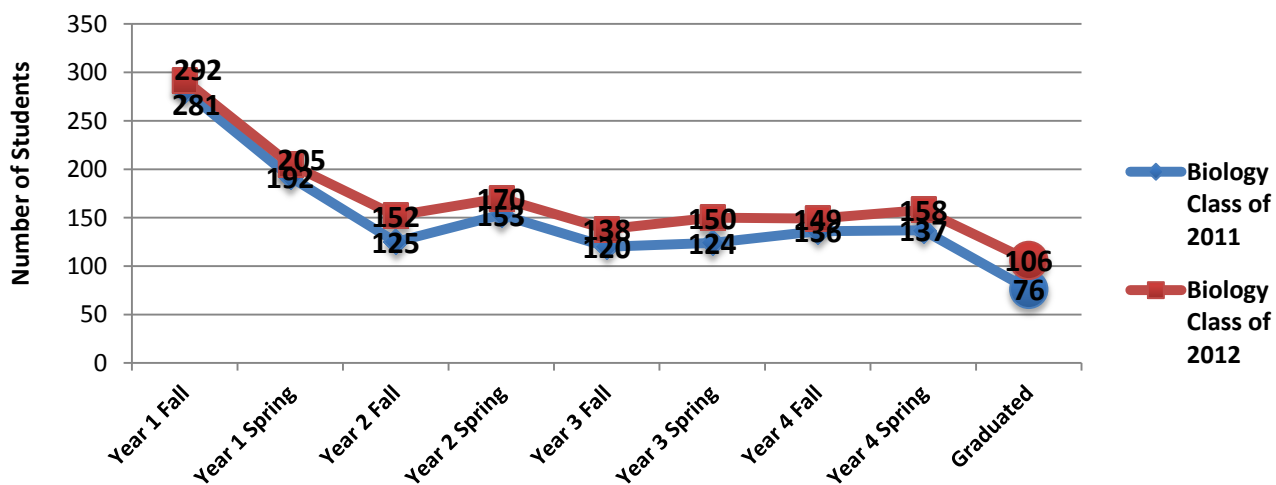
Environmental studies and Geology were two areas in which there were more degrees conferred than expected based on number of freshman who declared majors in these areas (see Figure 13), a difference likely due to students changing from a different STEM major to one of these majors. In 2010 and 2011, geology majors increased 220% and 120%, respectively. Large gains were noted in Environmental studies, as well. In both years, only 1 freshman declared this major, but four years later there 3 graduates (2011) and 4 graduates (2012).

Figure 13. Comparisons of Majors to Degrees Conferred, Classes of 2011 & 2012 in Environmental Studies/Science and Geology



There were some positive changes in graduation rate when comparing the classes of 2011 and 2012. As illustrated in Figure 14, the number of freshman biology majors in the class of 2011 was 281, although four years later, 76 biology degrees were conferred. This is a 27% graduation rate. For the class of 2012, however, the graduation rate increased to 36%, from 292 declared freshman biology majors in 2008 to 106 graduates in 2012.

Figure 14. Biology Majors, Classes of 2011 & 2012: 4-Year Counts and Graduation Rates



Graduation rates for the other STEM disciplines are included in Table 6. Graduation rate gains were noted in chemistry-dual degree engineering, physics, and environmental studies. STEM education majors are not included in these calculations because they typically do not declare the majors until the sophomore or junior year.

Table 6. Retention/Graduation: Classes of 2011 & 2012

STEM Field	2011 Graduation Rate	2012 Graduation Rate	Gain/Loss
Chemistry (BA)	13%	9%	Loss
Chemistry (BS)	42%	36%	Loss
Chemistry/Engineering	17%	50%	Gain
Computer Science	22%	15%	Loss
Environmental Studies	200%	300%	Gain
Environmental Science	60%	40%	Loss
Geology	220%	120%	--
Mathematics	41%	25%	Loss
Physics	43%	80%	Gain
Physics/Engineering	0	0	--

When reviewing 4-year trends in number of STEM majors for the classes of 2011 and 2012, a pattern was noted, indicating that in most STEM areas, there is a large decrease in majors between freshman and sophomore years. For example for the class of 2011 (freshman in 2007), chemistry BA majors decreased by 48%, chemistry (BS) majors decreased by 42%, biology majors decreased by 56%, and computer science majors decreased by 39%. This decrease was calculated by comparing the number of declared majors in fall of the freshman and sophomore years.

Summary

The majority of students who completed the 2011 Summer Bridge Program enjoyed the experience and believed it was challenging and beneficial. Data indicated that most students who entered the program as STEM majors planned to remain STEM majors or became even more interested in STEM because of their Bridge participation. For the few students whose interest decreased, reasons given related to feeling unprepared to be successful. Many Bridge participants believed the summer program gave them a good idea of what college would be like and prepared them for the rigors of college. Many also said the program served as a good refresher to prepare them for their freshman year. The challenging nature of the program also resulted in large percentages of students who said they were interested in receiving tutoring in math, science, and English. Most students had good experiences with student assistants, teaching assistants, RAs, and faculty who offered them support during the summer program.

Although the percentage of Bridge students who changed from a STEM to non-STEM major was slightly lower than the percentage of other non-Bridge freshman who were similar to them, additional supports in the freshman year may be warranted. These supports include academic assistance in English, math, physics, and advanced chemistry. Although many Bridge students believed they had an advantage over their peers because Bridge prepared them for college, comparisons of Bridge and non-Bridge students' Fall grades, as well as D/F/W statistics, did not bear this out. Also, preliminary data analysis revealed that students experience in XIDS 2002 during the Fall 2011 semester increased their interest in K-12 STEM teaching; however, it will be necessary in the future to ensure that data are collected from all students rather than a small percentage of students to determine whether changes in interest are accurate. If they are, additional courses or experiences related to teaching careers may be warranted for these students.

Preliminary analysis of number of declared STEM majors and STEM degrees conferred (2007-2012) reveal noteworthy differences in the number of freshman who declare STEM majors and the number who earn a STEM degree. More in-depth analyses are needed to track individual students' journeys from freshman year through graduation (and to account for those students who do graduate in a STEM field but take longer than 4 years to complete their program) to determine why so many STEM majors change fields within the first two years of their program. Further study may reveal what additional supports students need to choose a major that is right for them and to succeed in the coursework aligned to that major.

11. The mean of the values 3,4,5,6,10,14 is

- A) 5
- B) 5.5
- C) 7
- D) 12

12. An urn contains 3 black cubes, 2 red cubes and 5 yellow cubes. What is the probability that a randomly drawn cube is red?

- A) 2/10
- B) 3/10
- C) 5/10
- D) 10/12

13. A compound has a density of 5 g/cm^3 and you have 150 cm^3 , what is the mass of the compound?

- A) 30 g
- B) 150 g
- C) 500 g
- D) 750 g

14. Solve the equation below for x:

$$yx^2=R$$

- A) $x = Ry$
- B) $x = yR$
- C) $x = \pm yR$
- D) $x = \pm Ry$