Keeping up With Technology: Transitioning Summer Bridge to a Virtual Classroom

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Introduction

In past years, the United States has produced highly qualified individuals that are able to lead in innovations in science, technology, engineering, and mathematics (STEM) fields. These advances in such specified areas have been a major contributor to economic growth in the U.S. However the U.S. is facing a major challenge in that STEM bachelor's degree as a percentage of total degrees conferred has steadily decreased in the last decade.[1] Furthermore, as noted by the President's Council of Advisors on Science and Technology (PCAST) recent February 2012 report the US awards 300,000 degrees to students in the STEM fields, however to meet society's job demand this rate must increase by 34%. [1] In addition to increasing the number of individuals who pursue STEM degrees, a considerable amount of attention must be placed on increasing the number of African American, Hispanic American, and Native American students - traditionally underrepresented minorities (URM) - who pursue these fields of study. In 2012, only 11% of the degrees awarded in the STEM fields were to African American, Hispanic, or Native American students. [1] If we consider engineering alone, approximately 13% of the engineering bachelor's degrees were awarded to these underrepresented minority groups. [2] The disproportional number of minorities participating in the STEM fields may be attributed to a number of factors including but not limited to, a lack of motivation, interest and awareness of these fields, cultural adjustment to college and inadequate academic training in their primary and secondary education. [3] [4] [5]

Numerous programs and interventions have been designed to help increase the number of URM students pursuing and completing STEM degrees. The majority of these programs focus on the first two years of STEM college education because these years are critical in the retention and recruitment of STEM majors. [1] Summer bridge programs have long been used by colleges and universities to assist in increasing the number of underrepresented students in STEM fields. [3] [6] These programs are often characterized by the rigorous on campus academic training to prepare matriculating students for freshman courses and social activities to help familiarize students with "college-life." Reports on current summer bridge programs suggest that students who participate in such programs are more apt to successfully complete their first and second year of their academic careers when compared to their peers who did not participate in such programs. [4] [6]

The National Science Foundation (NSF) funded Louis Stokes Alliances for Minority Participation (LSAMP) Program provides support for a number of universities as they implement programs to increase the number of URM students successfully completing STEM baccalaureate degree programs and increase the number of students interested in pursuing and matriculating into graduate degree programs. [7] Activities implemented through the LSAMP program provide year round academic and nonacademic activities to increase students' motivation to persist and performance in their undergraduate STEM major. [8] The programs and activities include, but are not limited to summer research experiences, mentoring programs, bridge programs, academic support services, living learning communities, seminars, symposia, etc. This paper examines one program which is viewed as one of the largest and most enriching offered, the summer bridge

program. Despite the apparent advantages of the summer bridge programs its impact has been limited to only a small subset of students, which is a consequence of financial constraints of the individual universities and also student interest. Summer bridge programs for 25 students can cost upwards of $40,000. Also, some high school graduates work to earn money for school or travel during the summer prior to going to college, and participation in a multi-week residential program would be disruptive to the established plans of these students.

Post-secondary education summer transition/bridge programs typically recruit from target populations including underrepresented students, low income students, provisionally admitted students, and those who are at risk for low achievement during their college career. The programs range from 2 to 6 weeks with activities designed to be academically challenging and socially enriching. Often these programs choose to focus the academic training on courses that prove to be troublesome, such as pre-calculus, calculus, chemistry, and physics, in the early stages of a students' academic career. To mimic the freshmen experience, students are housed on campus housing and dine in tradition cafeterias on campus. [9] [10]

Transitioning existing on-campus bridge programs to online programs is a viable option to alleviate some of the financial constraints current universities encounter and also provides the flexibility that many students would welcome. Online programs may also allow more students to participate in such programs because of the decreased financial impact and the decreased physical/time constraints of being on campus. While there is some debate about the efficacy of online summer bridge programs, [9] we posit that the changing instructional methodologies in high school (online classes) and advances in social media make offering an online summer bridge program more attractive today. Virginia and Idaho recently passed laws requiring students to take at least one online course in order to earn a high school diploma,[10] and Minnesota passed a law that "strongly encourages" students to take an online course before graduating from high school. In 2011-2012 there were approximately 619,847 online K-12 course enrollments (i.e. one student taking a one-semester-long online course). [11]

The virtual classroom is becoming more commonly used among collegiate students and faculty members. A number of concerns have been associated with the use of such classrooms: "Are these types of classrooms able to prepare students for the rigorous journey ahead?," "Will the limited physical contact hinder students' ability to successfully make personal and professional contact?," "Will students find these classroom as engaging as classrooms that meet face to face?" [12] [13] Clark, et al. suggests there is no difference in the amount of information that is conveyed when comparing virtual to traditional classrooms. Furthermore, other studies suggest that the virtual classroom offers some advantages over classrooms that meet face to face, including lower cost, faster development of time pertinent materials, and development of technology literacy. [13] [14]

In the summer of 2012 an LSAMP alliance partner offered an online summer bridge program for its scholars. Following its partner institution model, in 2103 this university (also an LSAMP alliance school) held its first online summer bridge program. The alliance partner and institution of study, is a public university and has been considered a very high research university by Carnegie Foundation. Its high volume of engagement of its surrounding urban community provides a unique opportunity for funding and research for the institution's faculty and

students.[15] Our research focuses on this university's journey to transform the on-campus program to a totally virtual experience. Students who participated in both the online program and on-campus programs were interviewed. The 30 minute interviews were recorded and later transcribed to evaluate if there are any reoccurring themes between the two groups of students. Students who participated in the online summer bridge program are currently freshman students enrolled in STEM fields, while those who participated in the on-campus program are upper classmen and are reflecting on their freshman experience at the university. Researchers also compared the students' academic achievement in their freshman math and chemistry courses. Finally researchers identify strengths and weaknesses of using a virtual classroom.

University summer bridge description

On-campus bridge program

The on-campus summer bridge program was offered for four summers (2008-2011). This four week enrichment opportunity typically enrolled between 15-21 participants, all of whom had gained full admissions to an undergraduate STEM program at this university and intended to enroll in the fall. Participants enrolled in a math class (non-credit bearing pre-calculus class), a chemistry preparatory course (non-credit bearing), and a study skills course (1 credit). These courses were chosen because of the high rate at which URM students earned the grades of D or F or withdrew (D,F,W rate) from these freshmen courses; approximately 43% D,F,W rate in the chemistry course and approximately 36% and 42% D,F,W rate in the pre-calculus and calculus courses. Furthermore we selected topics that the instructors of these courses identified as needing remediation and would benefit the students the most when preparing them for their first year. The topics covered in the science and math courses are listed in Table 1.

Table 1 On-campus Bridge Program Course Topics

Math Course Topics	***Chemistry Course Topics***
Real Numbers	Chemistry Basics
Equations and Inequalities	Measurement
Exponents and Polynomials	Matter
Lines and Systems	Atoms, Ions, Molecules
Functions and Graphs	Formulas,
Rational Expressions	Equations and Moles
Geometry	
Trigonometry	

The math and science courses were taught by one instructor and a teaching assistant. The study skills course was taught by one instructor. The textbooks used in the math and science courses were supplied by the program and were the same textbooks used in the introductory chemistry and pre-calculus course offered during the regular semester. In addition to the textbooks, students were provided with housing in campus dorms and a meal plan (three meals a day) for the duration of the bridge program. Upon successful completion of the program, students were given academic credit for the study skills course and a stipend credited to their school accounts, the amount of which was predicated on their performance in the classes. Students also participated in field trips, laboratory visits, social activities, and orientation activities.

Table 2 outlines the financial obligations that the program assumed during the 2011 summer bridge program. This summer was one of the largest classes held at the university of study and serves as a maximum for cost analysis.

Table 2. On-campus Bridge Program Costs

Program Items	Cost	Quantity
Chemistry Textbook	$190	17
Calculus Textbook	$179	17
Meal Plan	$495	17
Housing	$336	17
Instructors Stipend	$2000	3
Teaching Assistant Stipend	$1000	2
Student Stipend	$200*	17
Social Activities	$4000	NA
Tuition	$256**	17
Total annual cost	**$41152**	

*average stipend award ** average of in-state and out-of-state tuition obligations

The total cost for one summer is $41,152.00. If the number of students were increased to 20 and then kept constant for five years each university would spend an average of $240,000 (accounting for some increase in tuition and other costs).We must also consider that 17 students represented less than 10% of the freshmen URM STEM majors. Thus the program would need to be expanded to reach a larger percentage of the target student population.

Online summer bridge program

The online summer bridge program is a three week program, first offered in August 2013. Thirty-three rising freshman enrolled the first summer. The program used an adaptive web-based intelligent assessment and learning tool, ALEKS [16], to teach both the chemistry and calculus preparation courses. A third online study skills course was also offered for the students. In ALEKS the instructors were able to choose the areas they wished to emphasize during the course and focused on student's mastery of those specific topics. The topics are shown in Table 3.

Table 3 Online Bridge Program Course Topics

Math Course Topics	***Chemistry Course Topics***
Real Numbers	Math and Algebra
Equations and Inequalities	Measurement
Exponents and Polynomials	Matter
Lines and Systems	Atoms, Ions, Molecules
Functions and Graphs	Stoichiometry
Rational Expressions	Simple Reactions
Radical Expressions	Thermochemistry
Exponentials and Logarithms	
Geometry	
Trigonometry	
Limits and Continuity	

ALEKS has been used in other on-campus and online summer bridge and preparation programs [9] [17] with some success. These courses are typically modeled after, courses taught during the regular semester. However, because of the restricted time period only selected parts of the course objectives are covered during the summer. Each ALEKS course begins with an assessment test to determine student proficiency in the topics that were to be covered during the course. ALEKS then establishes a set of lessons specifically tailored to the student's aptitude.

After each unit, students are given a test about the subject matter. If the student proves proficient, he or she is able to move on to the next unit. However, if the answers to both open ended and multiple choice questions reveal that the student needs extra support in a specified area, he or she is then given extra lessons to assist in the areas of weakness, and then allowed to review the previous unit.

In addition to the use of the ALEKS software, each course was assigned one teaching assistant to offer any further explanation of course material and track student progress for the duration of the program. The textbook for both the chemistry and math courses were available online and were the same textbook used during the regular academic semester. The study skills course used Blackboard [18], a learning management system (LMS) web-based platform used by other classes during the regular semester to deliver the course content. Students were given daily reading and writing assignments.

Table 4. Online Bridge Program Costs

Program Item	Cost	Quantity
ALEKS Math (book & software)	$45	33
ALEKS Chemistry (book & software)	$45	33
Teaching Assistant Stipend	$1000	2
Instructor Stipend	$2000	1
Student Stipend	$200*	33
Student Bonus Stipend	$100*	33
Total Annual Cost	**$16870**	

*average stipend award, max award $300

Students were asked to complete 70% of the each course to receive a stipend. Students were eligible to receive an additional stipend if they completed 100% of the course units by the end of their first fall semester. Table 4 outlines the financial obligations the online program assumed. The total cost for one summer was $16,870, an approximately 60% reduction from the on-campus program costs. Allowing for modest annual increases in costs, if the number of students were kept constant at 35 students the program cost would be approximately $90,000 to offer the over the course of five years.

One crucial factor to consider is that while 33 students signed up for the online summer bridge program, only 23 actually completed enough of the online course assignments (70% of the math and/or chemistry topics and/or all of the student skills assignments) to earn the stipend. When analyzing the impact of the online bridge program, only students who completed enough of the work to earn the stipend were considered in the assessment. The remaining ten students' course performance is presented as a comparison group.

During the summer of 2013 only 7% of eligible students enrolled in the program, but it is our hypothesis that with more publicity the program will expand as will the number of students that are impacted. Given limited and declining resources and a desire to allocate more funds to yearlong retention programs and programs for upperclassmen, the online program may provide a cost efficient alternative to the on-campus bridge program. However before such a decision can be justified, the impact of the programs must be measured. Those findings are discussed in the next section.

Bridge program's impact

Student interviews

In order to determine and compare the impact of the two programs both quantitative and qualitative assessment data was gathered. Students were interviewed individually for 30 minutes, starting with a brief introduction by the interviewer of the goal of the interviews and general personal introduction. Students were not given any incentives to participate in the interviews. As previously mentioned all students that were interviewed had participated in either the on-campus or the online summer bridge programs. The interview explored the participants' perspective about the summer bridge programs and its perceived impact on their academic performance during their freshman year. The questions also prompted the students to reflect on challenges they may have encountered as a student and how either the program directly or indirectly impacted how they were able to maneuver through and overcome those challenges. The questions allowed students to describe their experiences without any constraints and the students were encouraged to expand on their responses. The interview questions are shown in table 5.

Table 5 Interview Questions

1. Did the transition program help prepare you for your academic career?
2. Would your freshman year been different if you did not participate in the summer program?
3. What things do you do to ensure your academic career is a success?
4. Describe a difficult time that you encountered while in college and how you overcame it.

Data analysis

Nineteen students were interviewed, 10 from the on-campus bridge program and 9 from the online bridge program. This sample is only a small subset from the total participants but provided interesting early stage results about the programs' efficiency. Following Creswell's [19] description of the systematic process of data analysis in grounded theory, the researchers met to review the interview transcripts and developed, sorted, compared, and contrasted codes and categories until no new codes were created. Based on the qualitative analysis of the study the researchers identified the codes presented in Table 6.

When students were asked if the summer program helped prepare them for their academic career, 100% of the on-campus participants agreed that it indeed helped with their academic career. However, they openly admitted that their dedication to the work during the summer was a result of instructor's expectations of them and less of their own recognizance. Once the instructors were no longer there as a constant motivation students found it difficult to focus on their studies, and difficult to manage time efficiently.

> "Well the work really helped but, in the program we felt like we had to be there or like you or Alfred were going to come looking for us….. and wouldn't let us get away with anything…. When I got here nobody cared for real like if you went to class or not and I guess had more free time. So I had to get used to that….."

When students from the online program were asked the same question the responses were unanimous as well. They all believed that the course presented in the summer transition program helped recall to their memory details that proved to be important for their introductory course

work. However, students reflected that exercises in time management preformed during the summer helped manage their work load during the regular semester.

> "… doing the ALEKS part helped. I'm in honors, so the class sizes are smaller and like teachers the teachers are really watching you not like in a lecture style so I had to know more. I feel like I was a lot more prepared since I did the ALEKS program this summer…. It would have definitely been a struggle… We had to write out everything we have planned for the day so I like do that and make a check list of things I have to do so I won't forget…"

Students who participated in the online program were more comfortable in seeking help from their professors and external tutors during the regular school. Those who participated in the on-campus program relied on their peers and program staff, and needed further adjustment when those sources were no longer of assistance. One student described the impact of her peers' support in her journey to improve their academic standing.

> "…now I am trying to bounce back now cause my GPA isn't that great but I guess being more organized and my friends helping me out is how I'm getting through it. Cause you don't feel like you going through stuff alone. Like they know I'm there for them and they are there for me, and all of us were in the program together. I guess they are the ones I'm closest too. That has been the biggest help really just people being there..."

Despite the support system both students from the on-campus and online program, 80% and 77% respectively, believed that their freshman year academic performance would have been negatively impacted if they did not participate in their respective programs.

Table 6 – Data Codes

On-Campus Summer Bridge Program	
Primary Codes	**Open Coding**
Academic Preparation	Acted as a "refresher" courses in both Chemistry and Math
	Provided supportive teachers which developed a deeper understanding of course materials
	Course work assisted in freshman math and science courses
	Course work did not assist in higher level math and science courses
	Courses did not assist in developing skills to work independently
Peer Interactions	Assisted in building peer networks
	Peers were the main support system throughout academic career
Academic and Social Adjustment	Program visibility after the first year- lacking support from the program
	Difficulty adjusting to course with peers they were not familiar
	Lacked confidence in seeking external help from university resources for academic success

Online Summer Bridge Program	
Primary Codes	**Open Coding**
Academic Preparation	Summer courses reinforced and expanded on material covered in high school
	Course work was almost identical to courses topics covered during the regular semester
	Course work proved to be challenging and forced students to actively seek help to complete assignments
Peer Interactions	Program did not facilitate peer interaction
	Students felt isolated when entering the fall semester at university
	Students felt a lack of peer support from program participants
Academic and Social Adjustment	Students found it easy to seek out external university support
	Students joined extra curricula activity to receive peer interactions
	Over committed themselves to social and academic obligations

To quantify the impact on the students' performance during their freshman year, their grades from first semester freshman math and chemistry courses were examined. Not all bridge students enrolled in a math and/or chemistry course their first semester. Furthermore students were placed into the appropriate math or chemistry course based upon their performance on a math placement test and chemistry placement test. The four math courses the students enrolled in included: MATH 141 Algebra with Applications, MATH 151 Precalculus, MATH 200 Calculus and MATH 201 Calculus 2. The chemistry courses the students enrolled in included: CHEM 100 Introductory Chemistry, CHEM 101 General Chemistry I, or CHEM 102 General Chemistry 2. Figures 1a and b depict the grade distribution from the students who completed the on-campus program and online programs, respectively. Figure 1c presents the grade distribution for the remaining online summer program students who did not complete the course requirements.

Figure 1A On-Campus Bridge Student Grade Distribution. Note that 14 of the 17 of the on-campus Summer Bridge students enrolled in a math and 13 of the 17 students enrolled in chemistry class their first semester. Math includes students who have taken college algebra, precalculus, and calculus (Math 141,151, and 200). Chemistry includes students who have taken introductory chemistry I, general chemistry II (Chemistry 100, 101, and 102).

A)

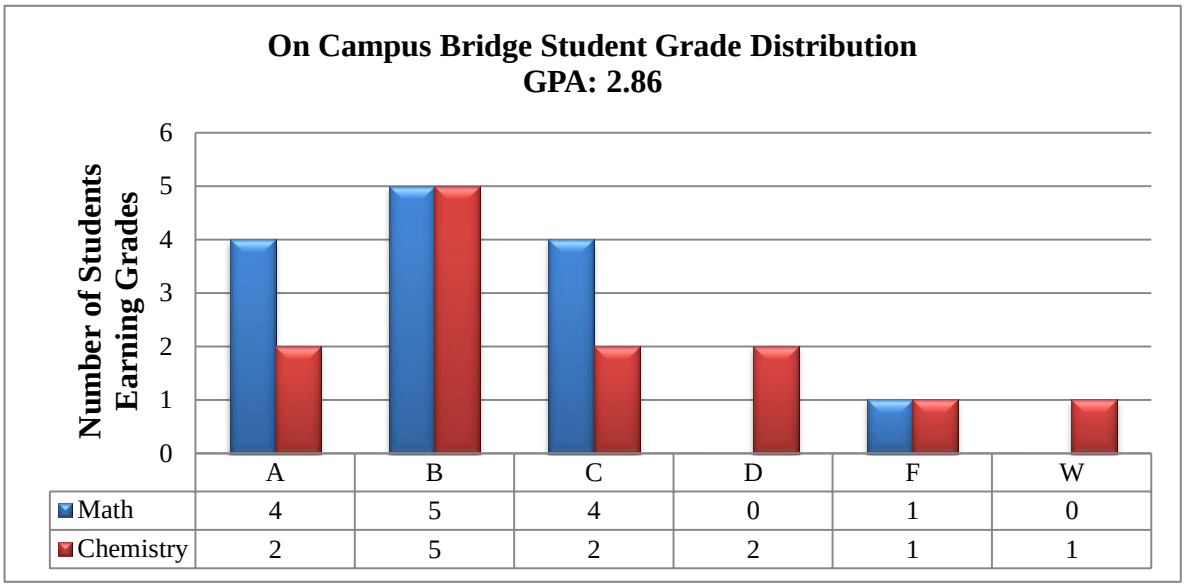


Figure 1B Online Bridge Student Grade Distribution. Note that 17 of the 23 of the online Summer Bridge students enrolled in a math and 16 of the 23 students enrolled in chemistry class their first semester. Math includes students who have taken college algebra, precalculus, and calculus (Math 141,151, and 200). Chemistry includes students who have taken introductory chemistry I, general chemistry II (Chemistry 100, 101, and 102).

B)

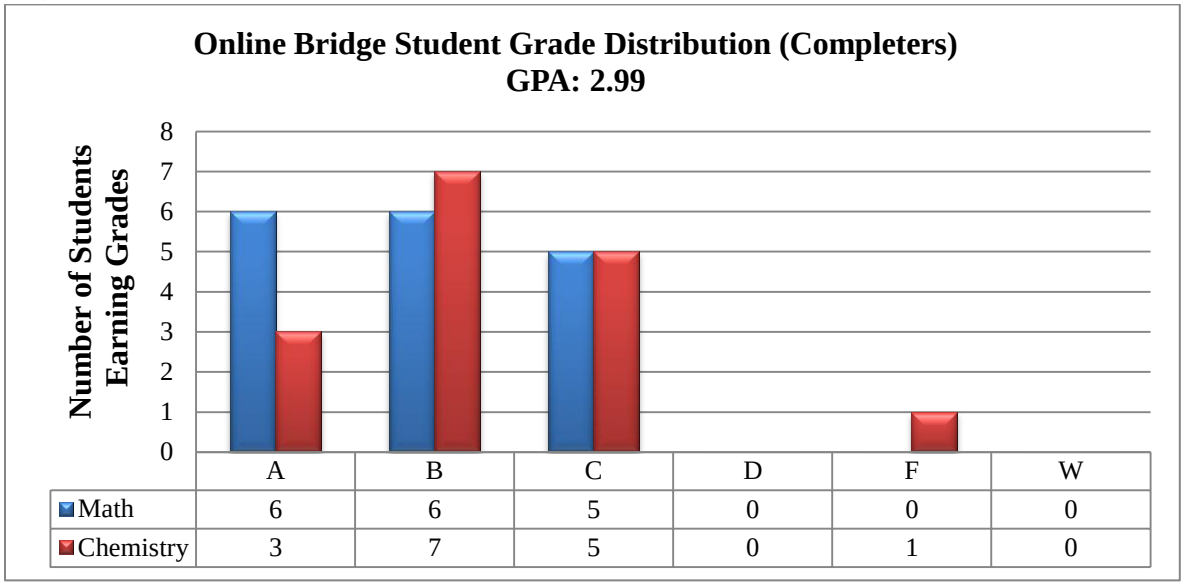
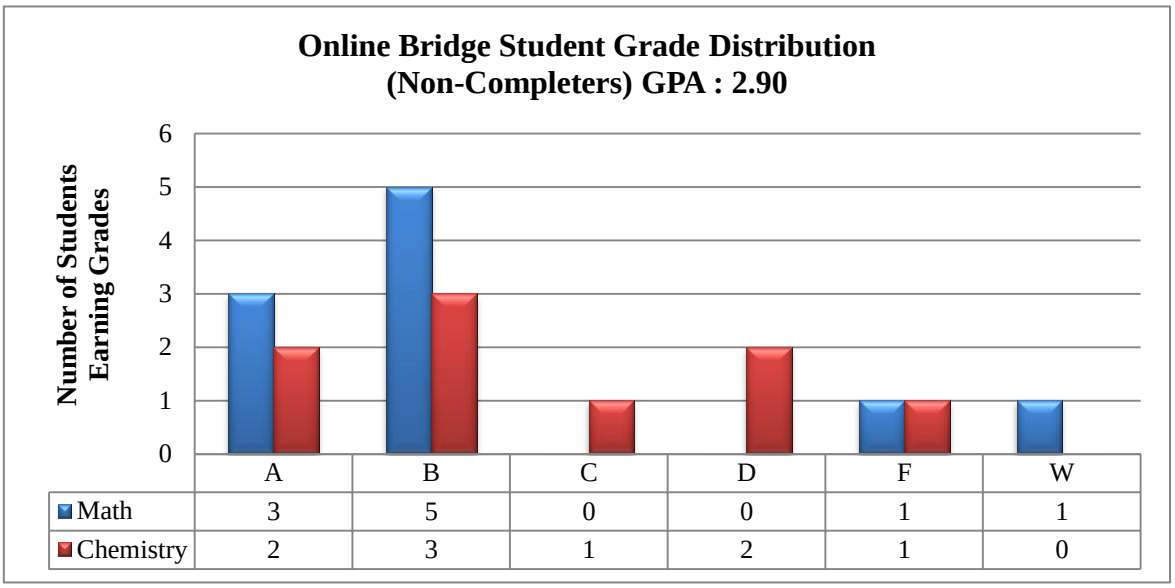


Figure 1C Online Bridge Student Grade Distribution for those who did not complete the online program. Note that all of the online Summer Bridge students who did not complete the program enrolled in a math and 9 of the 10 students enrolled a chemistry class their first semester. Math includes students who have taken college algebra, precalculus, and calculus (Math 141,151, and

200). Chemistry includes students who have taken introductory chemistry I, general chemistry II (Chemistry 100, 101, and 102).

C)



Fifty-two percent (52%) of the on-campus bridge students evaluated received a final grade of an A or B in their freshman math course and the D, F, W, rate was 7%. Only 41% received a final grade of A or B in their freshman chemistry course and the D, F, W rate was 23%. It is noteworthy to mention of the 17 students only one student failed the math and chemistry course during their freshman year. Of those online bridge program participants, 48% received a final grade of A or B in their freshman math course (0% D, F, W rate); while 43% of the students received a final grade of A or B in their freshman chemistry course (6% D, F, W rate). None of the described students failed math during their freshman year and one student failed chemistry during their freshman year. The average GPA of the online students was slightly higher than those of the on campus students. We speculate, from individual interviews, that this slight difference may be due to the shorter adjustment period required by the online students to actively seek assistance and work independently. In the comparison group 80% of the students earned an A or B in their math course (20% D, F, W rate) and 55% of the students earned an A or B in their chemistry course (33% D, F, W rate).

Suggested Improvements

From both interviews and GPA analysis we believe that the online summer program is able to efficiently prepare students for the academic rigors of freshman year course work. However, the totally virtual nature of the program does not facilitate peer interaction or building peer support networks. In future iterations of the program we plan to incorporate a one week on-campus experience for those students. This week will incorporate activities to promote team building and focus on student networking skills. The remaining 4 weeks of the program will be conducted totally online using the ALEKS software and Blackboard LMS. We believe that structuring the program in this manner will promote self-motivated workers as we have

previously seen in the online students, but also enhance the peer system that number on-campus students believed an essential part of their educational experience.

Conclusion and future work

While a copious amount of anecdotal evidence supports the belief that summer bridge programs are beneficial to students, there is a recognized lack of empirical data on the impact of bridge programs in the field of educational research. [20] However, most work examining how bridge programs provide benefits to students support the main concepts of Tinto's [21] theoretical framework of persistence in higher education, which includes academic and social integration as important factors in a student's decision to persist. In Tinto's framework, academic integration relates to the student's ability to meet institutional requirements, whereas social integration relates to the student's ability to feel connected to those surrounding him or her.

There is also evidence that summer bridge participation may have beneficial effects on social cognitive variables - namely self-efficacy (one's belief in his or her ability to accomplish a domain-specific tasks) and outcome expectations (one's beliefs about the consequences related to completing a specific action) – which may, in turn, improve student outcomes. [22] [23] One attempt to quantify the effects of summer bridge programs showed statistically-significant increases in measures of academic self-efficacy and academic skills following bridge program participation among a small sample of at-risk students attending a predominately white institution (PWI). [24] The study also showed a statistically significant positive relationship between academic self-efficacy and first semester GPA. These particular variables are important in light of a study of 400 freshman of all majors at a large Midwestern public university that found first-year GPAs and measures self-efficacy and outcome expectations taken midway through the second semester to be strong predictors of freshman-to-sophomore retention. [25] These results provide another avenue of evaluation of our program.

Future evaluation of the online bridge program effectiveness will borrow heavily from the above theoretical framework by attempting to measure the impact of the program in terms of student gains in academic and social integration. [26]. Academic engagement will be measured quantitatively, using student achievement measures and social cognitive constructs that have been shown to be correlated to retention in STEM majors. The evaluation will use a mixed methods approach to measure social engagement. [23] Surveys will measure quantitative indicators of social engagement, and document review and interviews will help discover whether the online program provides opportunities for social engagement that participants utilize. The evaluation will answer three basic questions to determine whether the online program adequately supports the academic and social integration of participants:

1. When examining predictors of academic success and persistence in the STEM majors, are there significant differences between OSTP participants and students who previously participated in the residential version of STP?
2. Does the current format of OSTP provide adequate opportunity for social interaction and engagement among participants, and are participants taking advantage of these opportunities?

3. Do measures of perceived academic and social integration reported by OSTP participants differ from those reported by similar STEM majors who did not participate in OSTP?

Findings from the proposed evaluation will be useful in guiding the decision-making processes of online bridge program staff in its ongoing efforts to refine the program with the intent of improving student outcomes (i.e. minority STEM graduation rates). The findings will also illuminate the ways in which online programs are or are not effective in providing incoming students the recognized benefits of summer bridge programs.

Bibliography

1. **President's Council of Advisors on Science and Technology.** *Engage to Excel: Producing One Millin Addditional College Graduates with Degrees in Science, Technology, Engieering, and Mathematics.* Washington DC : Executive Office of President, 2012.

2. **Yoder, Brian.** *Engineering By The Numbers.* Washington : American Society for Engineering Education, 2013.

3. *The Case for Summer Bridge; Building Social and Cultural Capital for Talented Black STEM Students.* **Stolle-McAllister, Kathleen.** 2, 2011, Science Educator, Vol. 20, pp. 12-22.

4. *Bridging Multiple Worlds: How African American and Latino Youth in Academic Outreach Prgrams Navigate Math Pathways to College.* **Cooper, Catherine R., et al., et al.** 2, 2002, Applied Developmental Science, Vol. 6, pp. 73-87.

5. *Does Cultural Capital Matter?: Cultural development and quality of Life.* **Kim, Seoyong and Kim, Hyesun.** 2008, Springer, pp. 296-213.

6. *Bridge to Sucess: Insight tnto Summer Bridge Program Students' college Transition.* **Walpole, Mary Beth, et al., et al.** 1, 2008, Journal of the First year Experience & Students in Transition, Vol. 20, pp. 11-30.

7. National Science Foundation Louis Stokes Alliance for Minority Participation. [Online] National Science Foundation. [Cited: January 2, 2014.] http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13646&org=HRD&from=home.

8. Vrignia/ North Carolina Alliance for Minority Participation. [Online] University of Virginia, 2013. [Cited: January 2, 2014.] http://www.virginia.edu/amp/aboutlsamp.html.

9. *Summer Transition Program: A Model for Impacting First Year Retention Rates for Underrepresented Groups.* **R. Alkhasawaneh, R. Hobson.** Austin, Tx : Proceedings of ASEE Annual Conference and Exposition, 2009.

10. *Pre-College Mathematics Preparation: What works?* **R. Alkhasawaneh, R. Hobson.** Louisville, KT : Proceedings of ASEE Annual Conference and Exposition, 2011.

11. *Assessment of factors impacting success for incoming college engineering students in a summer bridge program.* **Reisel, John R., et al., et al.** 4, 2012, International Journal of Mathematical Education in Science and Technology, Vol. 43, pp. 421-433.

12. **Sheehy, Kelsey.** U.S. News Education High School Notes. [Online] U.S. News. [Cited: January 2, 2014.] http://www.usnews.com/education/blogs/high-school-notes/2012/10/24/states-districts-require-online-ed-for-high-school-graduation.

13. **Watson, John, et al., et al.** *Keeping Pace with K-12 Online & Blended Learning.* Durango : Evergreen Education Group, 2012.

14. *Leveraging Technology for Chemical Sciences Education: An Early Assessment of WebCT Usage in First-Year Chemistry Courses.* **Charlesworth, Paul and Vician, Chelley.** 11, 2003, Journal of Chemical Education, Vol. 80.

15. **Clark, Ruth, Kwinn and Ann.** *The New Virtual Classroom.* San Francisco CA : Pfeiffer, 2007.

16. *Determining factors of the use of e-learning environments by university teachers.* **Mahdizah, Hossein, Biemans, Harm and Mulder, Martin.** 2008, Elsevier: Computers and Education, Vol. 51, pp. 142-154.

17. Carnegie Foundation for the Advancement of Teaching. *Carnegie Foundation for the Advancement of Teaching.* [Online] http://www.carnegiefoundation.org/.

18. **ALEKS Corporation.** ALEKS. [Online] ALEKS Corporation. [Cited: January 2, 2014.] http://www.aleks.com/.

19. *A Comprehensive Approach to Promoting First-Year Success of Pre-Health Students.* **Dumke, Erika and Kevin, Harris.** Atlanta : s.n., 2013. National Conference on Students in Transition.

20. **Blackboard Inc.** Blackboard. [Online] Blackboard Inc. [Cited: January 2, 2014.] www.blackboard.com.

21. **Creswell, John.** *Qualitative Inquiry and Research Design: Choosing Among Five Approaches".* s.l. : SAGE , 2013.

22. *Evaluation of summer bridge programs.* **Garcia, Lisa D. and Paz, Chiara C.** 4, 2009, About Campus, Vol. 14, pp. 30-32.

23. *Dropout from higher education: A theoretical synthesis of recent research.* **Tinto, Vincent.** 1, 1975, Review of Educational Resarch, Vol. 45, pp. 89-125.

24. *Social cognitive predictors of adjustment to engineering majors across gender and race/ethnicity.* **Lent, Robert W., et al., et al.** 2013, Journal of Vocational Behavior, Vol. 83, pp. 22-30.

25. *Understanding students' online interaction: Analysis of discussion board postings.* **Song, Liyan and McNary, Scot W.** 1, 2011, Journal of Interactive Online Learning, Vol. 10, pp. 1-14.

26. *Bridging the Pipeline: Increasing Underrepresented Students' Preparation for College Through a Summer Bridge Program.* **Strayhorn, Terrell L.** 2, 2011, American Behavioral Scientist, Vol. 55, pp. 142-159.

27. *Social-cognitive predictors of first-year college persistence.* **Kahn, Jeffrey H. and Nauta, Margaret M.** 6, 2001, Reserach in Higher Education, Vol. 42, pp. 633-652.

28. *Predicting voluntary freshman year persistence/withdrawal behavior in a residential university: A path analytic validation of Tinto's model.* **Pascarella, Ernest T. and Terenzini, Patrick T.** 2, 1983, Journal of Educational Psychology, Vol. 75, pp. 215-226.