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EXCEED: Excellence in Your Engineering Education Summer Transition Program

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EXCEED: Excellence in Your Engineering Education Summer Transition Program

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EXCEED: Excellence in Your Engineering Education Summer Transition Program

Abstract

EXCEED: Excellence in Your Engineering Education is a ten day, residential summer transition program that was designed to improve retention and graduation rates at San José State University (SJSU). SJSU is a large, public institution in the West with a very diverse student population. However, the university has lower graduation and retention rates for certain student populations in engineering including underrepresented groups and first generation college students. This transition program was designed to meet five outcomes: acculturate the students to the College of Engineering and the university, enhance math and writing preparation, build community amongst the cohort of students, enhance study skills, and introduce engineering design principles and an exposure to the engineering field. These outcomes were chosen based on a literature review of student success and through focus groups with freshmen in our college.

To meet the outcomes of the program, a set of twenty learning objectives were created. Then activities were designed to meet these learning objectives. Workshops on writing and math were included to better prepare students for the level of work needed in their first year classes. Resources in the university were highlighted to students through a “campus resource hunt” and through workshops with key university staff on topics including counseling, health services, time management, and career resources. Students were exposed to the engineering field through industry tours and guest lecturers.

One key aspect of the program was that the incoming freshmen worked on a community based, service learning project. In the service learning project, students worked in small teams to build something for a local non-profit agency. These included an after school center, a community garden, a women and children’s shelter, and a food and clothing distribution center. The projects were designed to be relatively small projects that could be accomplished in ten days with no engineering or construction experience. The primary goal of the project was to teach the students the engineering design process. The steps included brainstorming, narrowing down their design options, communicating their design idea to the stakeholder, incorporating feedback into their design, managing the project, and working together as a team. This learning could be accomplished through a range of different project types. However, research has shown that using a community service project, known as service learning, has a number of benefits including increased motivation towards using engineering to better society and increased retention and graduation rates in engineering, particularly among women and under-represented groups.

The program utilized peer mentors who worked closely with the students, with each peer mentor assigned to a small group of incoming students. One key role the peer mentors performed was

teaching the incoming students strategies for student success including time management, working in groups, and study skills.

Assessment of how well the program met the outcomes and specific learning objectives was conducted in an electronic survey following the program and follow-up focus groups towards the end of their first semester. Students indicate the program was successful in meeting all of the objectives, particularly familiarizing students with the University, building community, and introducing students to the engineering design process through the service learning project. Revisions of the math, writing, and study skills components are planned for the second pilot program to more closely integrate them with the engineering projects.

Background

Although students' aptitude in science, technology, engineering, and math (STEM) fields used to be linked with their persistence rates, science and engineering education has begun to change. Research suggests that many students who leave engineering majors, for example, are in good academic standing and performing well in the classroom. However, these students have a lower positive "perception of the work engineers do and for the engineering profession".¹ A major component of the EXCEED project is to emphasize the social relevance of STEM careers.

Extensive research has documented the need for integrating student success practices into the first year to increase student success in science and engineering. Research indicates that high-impact practices significantly increase student retention among all students, but especially underrepresented students.^{2,3,4,5,6,7} These activities often provide students with an identifiable peer group and make the campus feel more intimate. Several studies have also reported that high impact practices improve retention rates in STEM fields.^{8,9} The first year of college for undergraduate students can dictate the rest of their college experience.^{10,11} If there is a structure in place for students to succeed in their first year, then there is a probability that the momentum of success will perpetuate. Student engagement matters most during the critical first year of college.^{12,13,14} Support during the first year is even more critical for underrepresented students who come into the university with different needs.^{15,16,17,18} Many SJSU students are first-generation college students; for these students, college brings extra challenges compared to students of other backgrounds.^{19,20,21} Many of these students lack the social knowledge as to how to navigate the college environment²² and how to find support at the institution.^{23,24} Therefore, emphasis was made in the EXCEED program development to connect students with the resources on campus to build a foundation for stronger engagement.

Research shows that well-designed student learning communities lead to increased student engagement on campus and increased retention and graduation rates.^{25,26} Underrepresented students benefit from being placed in learning communities^{27,28,29} with purposeful integration into the university environment.^{30,31} In a longitudinal study of thirteen two-year and six four-year institutions, Engstrom and Tinto found that, across institutions, students who participated in

student learning communities were more engaged in the classroom, had higher freshmen to sophomore retention rates, and perceived greater encouragement and support on campus.^{32,33} As a result, first-year students may feel a sense of community and belonging to an institution with embedded peer activities and components throughout their academic pathway that motivates them to continue in college.³⁴ The programming in EXCEED attempted to build a deliberate community that would last through the students' first year and beyond.

Successfully bridging the gap between high school and college is difficult for many students.^{35,36} Extensive research at other institutions has shown that summer transition programs can significantly increase the retention and graduation rates of underrepresented students.^{37,38,39,40,41} In designing EXCEED, several models were adapted^{42,43,44} including our own experiences administering a summer residential program.⁴⁵

For example, at the University of Memphis, Russomano *et al.* were awarded the STEM Talent Expansion Program (STEP) grant by the National Science Foundation to decrease their attrition levels through Best Practices. One of the practices they focused on was a summer transition program, the Mathematics Bridge Bootcamp; a two-week event that provided information on STEM courses and careers, offered opportunities for networking with STEM faculty, professionals and peers, and provided participants context and instruction for mathematical skills. Another example of transition programs can be found at St. Augustine's College where Payne and Dusenbury implemented a Fall Bridge program for underrepresented, freshman, science majors.⁴² The Academic Bridge Program was designed to measure the retention rate in introductory, "gate-keeping", such as Biology and Chemistry. By instituting this eight-week program, St. Augustine's raised their average passing rate from 20% to 75%.

SJSU's summer transition program is unique in that it also incorporates team based service learning projects. The engagement with the community through the service learning project should enhance their engagement with learning and increase their dedication to engineering.⁴⁶ Research indicates integrating service-learning in the curriculum improves retention and graduation rates, particularly among underrepresented groups and women, and creates a stronger civic ethic among students.^{47,48,49} Students, particularly women and underrepresented groups, cite the ability to make a difference in society as one of the main reasons they choose careers in science and engineering.⁵⁰ Community-based service learning opportunities are a way for engineering students to become involved and make a difference in their own communities.

Freshmen Focus Groups

In addition to best practices learned from the literature, information about the needs of incoming freshmen was obtained through focus groups. In Spring 2012, two focus groups were conducted with twelve SJSU freshmen, women and students from underrepresented groups who were randomly chosen from the roster of the Introduction to Engineering class. The goal of the focus group was to obtain first-year engineering students' perspectives on which factors they felt led to

success in their first year at SJSU and what advice they wish they were provided with before beginning college to enhance their academic success and transition to the university. The questions are given in Appendix A. The themes from the focus groups are summarized below.

Time management: The reality of college-level coursework is that you need to be more organized and spend more time studying and completing assignments. Students also need to be realistic about the number of units they enroll in and if they are able to complete the corresponding workload, given their other obligations. The first-year students suggested the use of a planner and to take care of action items as early as possible to avoid “cramming” at midterms. First-year students emphasized to schedule time for relaxation and socialization as well as for academic tasks.

Stress management: Participants emphasized the need to relieve stress on a daily basis in healthy ways due to the fact that stress can “build up” and accumulate across courses.

Academic and Study Skills: Participants stressed the need to take notes, and even re-write notes for every class; merely sitting and listening is not enough. They also recommended that other students do all of the practice problems for math to reinforce skills. Participants also suggested going to the library or the quiet study lounge in the dorms if their living arrangement with roommates is too noisy to study effectively. They suggested that study groups are very helpful, as long as students make sure the group stays on track and makes the most out of the study time. Participants mentioned to check their email and course management systems daily so that they would not miss any important messages or updates. They advised others to never skip classes, as the amount of content missed is more than one would think.

Networking with other students: First-year student participants stated that involvement in professional and student organizations and clubs was very helpful in that they could find a more experienced student who can serve as a mentor. More experienced students can answer questions that would take a first-year student months to figure out on their own, and they can direct students to necessary resources. Participants emphasized that being open to new friendships amidst diversity was crucial, and that they found allies where they least expected. The new friends and allies helped participants cope with homesickness during their first year at the university.

Interacting with Faculty: Participants reported that it can be intimidating to visit faculty during their office hours but ultimately their advice and guidance was very beneficial.

Independence / Autonomy: Participants stressed the importance of self-discipline upon arrival at the university. They advised EXCEED students to make good decisions based on long-term goals rather than immediate short-term goals that may be more fun.

Cohabitation / Roommates / Residential Life: Participants reported that effective communication and learning to compromise with roommates in residential living was crucial. In the case of disagreement, they stated that additional skills were needed such as conflict resolution. Students also stressed the importance of staying away from others who have bad habits and learning to say no and assert one's self.

Finances: Budgeting was very challenging for the first-year student participants given the cost of living and cost of educational supplies such as textbooks.

Focus group themes not only assisted the program director and staff to plan the EXCEED activities and content, but were also converted into a handout for EXCEED students titled "Advice from Last Year's Frosh".

Engineering Pathways to Success

EXCEED is part of a larger College wide initiative for student success known as Engineering Pathways to Success (EPS). EPS is designed to increase the number and diversity of Santa Clara county high-school students interested in STEM and prepare them to succeed in college programs and STEM careers. EPS leverages SJSU's relationships with the local K-14 community, statewide partners, and Si Valley industry to focus our strategy on three components:

- 1) Facilitate Project Lead the Way (PLTW) adoption by middle and high schools (including teacher/student enrichment through training, workshops, best practices, and school visits from our Engineering Ambassadors)
- 2) Host Summer Core Training for Teachers (77 K-12 teachers trained to date as of Summer 2012 at SJSU)
- 3) Offer the EXCEED Summer Program for incoming first year engineering students to help them transition from high school to college

At SJSU, EPS began with a comprehensive outreach program to local middle and high schools. EXCEED was a logical next step in our EPS program portfolio. As many of our incoming local students are underrepresented students, EXCEED provides these students with a purposeful transition to college.

Framework for the Summer Transition Program

The overarching goal was to design a summer transition program which improved retention rates in good academic standing of engineering students. A ten day residential program was designed that was offered as a pilot program in August 2012 with thirty-two participants. The cost to each

student was only a \$100 registration fee; most of the program costs were covered by corporate donations from EPS partners.

All first year students admitted to the College of Engineering for Fall 2012 were contacted via e-mail and provided with information about the program and steps to apply. The EXCEED staff developed a flyer which was distributed to 552 admitted students during the College of Engineering Open House in April, 2012. At the event the students had an opportunity to speak with staff and the program director about EXCEED details. In addition to the Open House, the flyers were disseminated at several outreach events at local high schools. Last, the application and detailed information were posted on the College of Engineering website. Students had an opportunity to submit their application on-line until the first week of May, 2012.

The goal was for the admission to the summer transition program was to target students at risk for retention, in particular women, students from underrepresented groups, first-generation students, and those with math skills at the pre-calculus level. Our internal data shows that this pre-calculus group has a lower retention rate even though they have aptitude sufficient to succeed. This admission goal was not accomplished successfully during the first pilot program because the applicant pool itself did not reflect the desired diversity. It was also found to be difficult to determine the math ability level. The admission to the summer transition program was done before the students had taken the university's math placement exam. The admitted EXCEED group ended up being in four different incoming math levels their first semester. Of the thirty-two admitted students, 26% were female, 10% African American, 23% Latino, and 29% were first generation college students.

Once students were admitted to EXCEED, we communicated to them primarily via e-mail. All students were sent a detailed handbook which included information about student expectations, housing, College of Engineering map, meals, emergency contact information, parking instructions and agenda for the first day of arrival.

During the EXCEED summer program, the students lived together in a residence hall and had scheduled events for the full day and evenings. These activities were focused around the five main objectives of the program: acculturate the students to the College of Engineering and the university, enhance math and writing preparation, build community amongst the cohort of students, enhance study skills, and introduce engineering design principles and an exposure to the engineering field. Within each of these outcomes, specific learning objectives were developed and then activities were designed around those objectives. The outcomes and learning objective design were based on focus groups with freshmen engineering students about what they felt were the challenges of their first year, the EXCEED staff's own experience working with students, and literature review on issues critical to retention and student success of engineering students. The discussion below focuses on the design and assessment of program

activities for each of the five outcome areas. The specific learning objectives are given in Table 1 in the Assessment section.

Acculturate Students to the College and University

Both the literature and focus groups with SJSU freshmen indicate the importance of engagement on campus to student success. A primary goal of EXCEED was to get the students familiar with the resources on campus, including current students, staff and faculty. Roughly nine hours of direct programming was dedicated to this outcome including the activities detailed below.

Peer Mentors: A core part of the program was peer mentors. Five peer mentors each worked with a small team of the EXCEED students (six to seven students per team) throughout the program. The peer mentors had served as peer mentors for the College's Engineering Student Success Center during the academic year and had rigorous training in advising and mentoring. The peer mentors formally interacted with the EXCEED students through active participation in the projects and activities and leading nightly small discussion groups and informally during meals and break times.

Campus Resource Hunt: Teams of students went on a photo "scavenger" hunt to discover the resources across campus, including the library, counseling, registrar, bursar's office, writing center, and tutoring and advising centers.

College of Engineering Tour: Students went on a comprehensive tour of the building highlighting classrooms, student club space, laboratories, and department offices.

Student Panels: Groups of current students spoke in panels during dinners including panels with the peer mentors, advice from first year students, student club representatives, and students with global travel as part of their SJSU experience.

Enhance Math and Writing Preparation

A primary goal was to strengthen the academic success of the EXCEED students. The EXCEED program included ten hours each of math and writing workshops. The workshops were taught by faculty who teach pre-calculus and remedial English classes using a set of topics designed by surveying faculty of freshmen and entry level engineering classes on the areas they felt students struggled with the most. The workshops included homework which was also used as a tool to teach time management and study skills.

Build Community Amongst the Cohort of Students

In addition to spending all day and evening together for ten consecutive days, roughly twelve hours were dedicated to social activities to build community amongst the EXCEED students.

These included time to explore the downtown and a nearby science museum in groups, bowling, a movie night, a board game night, and an outdoor games night.

Enhance Study Skills

First-year students are at risk for high stress levels, especially during their first semester midterm and final exams⁵¹ and high rates of attrition during their first year at the university. The goal of providing the various workshops such as time management and StrengthsQuest for EXCEED students was to give them resources to foster a positive academic experience in their first semester at the university. Ten hours were specifically dedicated to workshops on study skills. The details of those programs are described below. In addition, ten hours were formally dedicated to studying for the math, writing, and engineering assignments in the program.

Workshops: The SJSU director for peer academic success programs provided the StrengthsQuest workshop. StrengthsQuest is the educational application of StrengthsFinder, a research-based tool to leverage natural personal attributes for academic, personal, and professional success. Universities worldwide use the StrengthsQuest tool to foster student development in areas such as advising.⁵² Researchers have found that the use of strengths-based advising builds motivation, confidence, achievement, and persistence in higher education. In addition, an educational counselor provided a workshop on time management. Also, a workshop, hosted by the student health center, was held on wellness and balance.

Small Discussion Groups: The peer mentors led multiple small group discussions to help the EXCEED students analyze their study and teamwork skills on assignments in the program. Small group discussions also focused on transitioning to college and strategies for the first year.

Service Learning Project to Introduce Engineering Design Principles

A core part of EXCEED was a service learning project. The thirty-two students were divided into five teams in which they built projects for local non-profit service providers. This service learning project had a number of objectives. First, working with the local service providers would help introduce the incoming freshmen to the surrounding community while giving them tangible examples of how engineers can make the world a better place. The team nature of the projects was used to both foster a community in this cohort of students and provide them with a foundation of teamwork skills that would be needed in their future engineering classes and careers. The project provided a framework to teach the engineering design process. Last, the project was designed to increase their confidence in engineering. Many of the students reported this was the first time they designed and/or built anything and reported pride in their accomplishment.

The projects were chosen to be relatively simple projects that could be completed in the ten day period by students with no engineering or machining experience. The projects were a ramp for

an after school center to test the cars their children built, a shelving unit for a storage closet at an afterschool center, carts for transporting chairs and tables at a women and children's shelter, a compost bin for a community garden, and a supply cart for a food and clothing distribution center.

Over the ten day period, the engineering students spent roughly thirty-eight hours working on the project. The students began with an exercise where they worked in teams on some small design challenges for several hours. The teams were rotated, and they concluded by reflecting on their roles and effectiveness in the different teams and design and building processes. The community providers then gave presentations about their organizations and the need for their project. The engineering students selected a project. As a team, they visited the site and gathered the information necessary to create their design constraints. The students then went through a structured brainstorm exercise where they created a list of different ideas and solutions. They chose three ideas from their list and did a detailed analysis of how those ideas compared based on their design constraints. The teams chose a primary design based on this comparison and gave a formal, oral presentation to the group. For many of the incoming freshman, this was their first experience with PowerPoint, oral presentations, and asking questions in a professional talk so mentoring was given on all aspects of that. The teams then revised their design to incorporate the feedback from their peers. They then presented their ideas to the community partners as well as to some engineering faculty in "mock office hours". The "mock office hours" component was deliberately added to help students overcome the fear of going to office hours that was highlighted in the focus groups.

The teams created a final design and a detailed bill of materials. All the items were pre-dominantly made of wood. They then began the process of getting training in the wood shop, cutting their materials, and constructing their projects. The finished projects were then delivered to the community partners.

As part of the service learning project, the students were presented with different ways that engineers "make a world of difference". In small groups and in personal reflection, the students related this to their interests in engineering. The project concluded with formal presentations to their families at the end of the program that detailed the design and construction of the project and delivery of the project to the community site.

Exposure to the Engineering Field

The service learning project was designed to expose the students to the engineering design process in general but not to any specific engineering major. About thirteen additional hours of the EXCEED program was dedicated to introducing the students to different engineering fields.

Industry Tours: The students went on tours of a nearby company, with an emphasis on the green engineering design of the company's building and a tour of a workshop used by entrepreneurs for product design.

Guest Speakers: There were guest speakers at dinners that spoke about the history of computing, renewable energy, nanotechnology, and engineering ethics.

Workshops and Discussions: The Career Center presented a workshop on skills for career exploration. The students had small group discussions on opportunities and examples of how engineers positively impact society.

Assessment of the Program

Initial assessment of the program was done with an electronic survey completed at the end of the program as well as focus groups towards the end of the first semester. Currently, the academic success and retention rates of the EXCEED students also are being studied.

Thirty-one out of the thirty-two participants completed the final survey. Figure 1 shows the students' opinions as to how well the EXCEED program accomplished its primary objectives. 94% of the students stated the program was extremely or very successful in helping them to form friendships with the other students. Students felt the program successfully introduced them to resources in the College (84% felt it was done extremely or very well) and University (74% rated extremely or very well). The EXCEED program was successful in introducing students to the design process (0% said not very well or not at all with 74% rated extremely or very well) and the engineering field (87% rated extremely or very well). The students report the weakest components of the program being the math preparation (only 19% rated extremely or very well), writing preparation (only 16% rated extremely or very well), and study skills (32% rating very well but no students rated it extremely well).

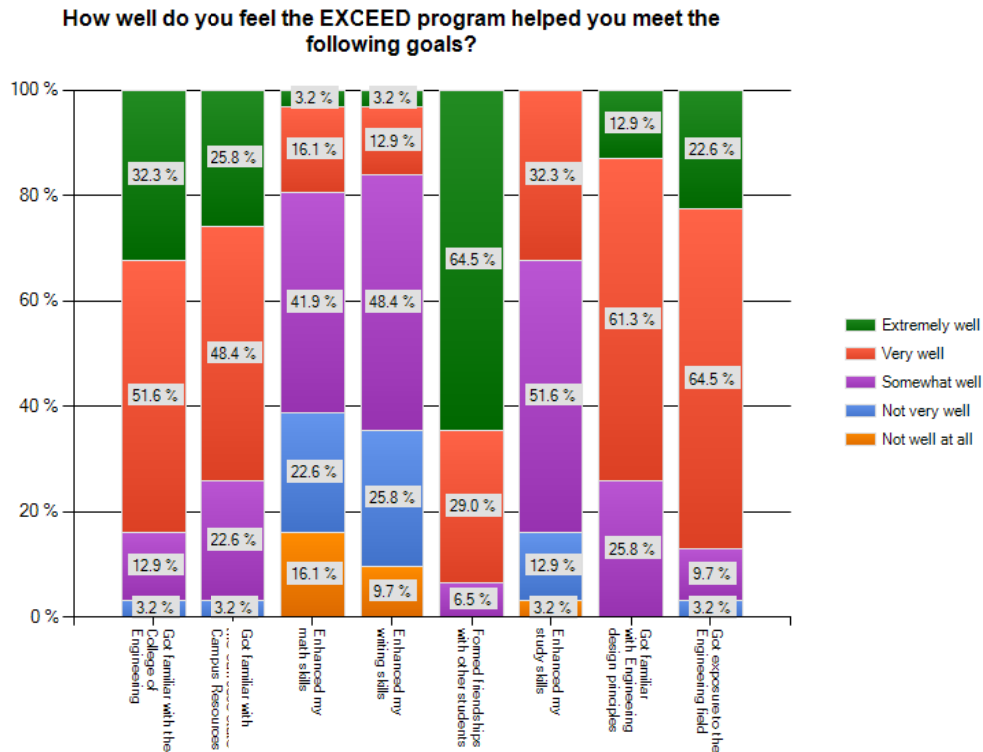


Figure 1: Opinion of EXCEED students on how well the program met the primary objectives.

The EXCEED students were also asked to rate how well the program accomplished more specific learning objectives, Table 1. Student opinion indicates the program was successful in meeting the specific learning objectives. This data also indicated that the students were not as satisfied with the math and writing component, with the majority feeling the program only somewhat well or not very well helped them utilize writing in engineering and identify their strengths in math and writing. The majority of students also noted that the program only somewhat or not very well helped them identify their learning styles and to use those in studying.

Table 1: Student opinions of how effectively the EXCEED program met specific learning objectives

How well do you think the EXCEED program prepared you to:	Extremely well	Very well	Somewhat well	Not very well	Not well at all
Engage in resources on SJSU's campus for academic support	16.1%	51.6%	29.0%	3.2%	0.0%
Interacting with faculty and staff	16.1%	64.5%	16.1%	3.2%	0.0%
Develop behaviors needed for academic success in engineering.	6.5%	58.1%	32.3%	3.2%	0.0%
Identify some student organizations and other COE programs of interest	22.6%	61.3%	9.7%	6.5%	0.0%

Discuss diversity in engineering	20.0%	56.7%	20.0%	3.3%	0.0%
Discuss social justice issues related to engineering	12.9%	41.9%	38.7%	3.2%	3.2%
Use math in engineering classes	3.3%	50.0%	26.7%	16.7%	3.3%
Use writing skills in engineering	3.3%	33.3%	40.0%	20.0%	3.3%
Identify your strengths in writing	6.5%	25.8%	45.2%	16.1%	6.5%
Identify your strengths in math.	0.0%	27.6%	37.9%	24.1%	10.3%
Avoid plagiarism and properly paraphrase and reference resource material.	12.9%	54.8%	29.0%	3.2%	0.0%
Perform a literature review using SJSU's resources.	0.0%	38.7%	25.8%	29.0%	6.5%
Identify commonalities with other EXCEED students.	25.8%	48.4%	22.6%	0.0%	3.2%
Determine effectiveness of a study group	16.1%	54.8%	16.1%	12.9%	0.0%
Identify your learning style and articulate strategies best suited for that style.	3.2%	35.5%	48.4%	12.9%	0.0%
Utilize study skills strategies that match your learning style.	3.2%	25.8%	61.3%	9.7%	0.0%
Design a study/work/life schedule for Fall semester.	9.7%	48.4%	32.3%	6.5%	3.2%
Ask the right questions in and outside of class.	9.7%	58.1%	32.3%	0.0%	0.0%
Discuss the technologies of several engineering companies and industries.	16.1%	77.4%	6.5%	0.0%	0.0%
Articulate the ethical and professional responsibility of engineering professionals.	6.5%	61.3%	29.0%	3.2%	0.0%
Formulate a solution to a socially relevant problem using the engineering design process.	9.7%	48.4%	38.7%	3.2%	0.0%
Identify the role engineering plays in solutions to critical societal problems.	16.1%	67.7%	16.1%	0.0%	0.0%

Follow up questions on the math workshops indicated that 92% of the students felt the workshops were best described as a review, only 4% felt the workshops were best described as preparing them for the coming semester, and 4% teaching them something new. For the writing workshops, 79% of the students felt the workshops were best described as a review, only 14% felt the workshops were best described as preparing them for the coming semester, and 7% teaching them something new. Qualitative comments indicate students did not see the relevance of the math, writing, and study skills to engineering. Revisions are planned for the second pilot program to incorporate these aspects into the engineering project and engineering exploration workshops rather than to have them as separate workshops. This integration should better highlight the importance of these skills in engineering.

The researchers held three focus group sessions with EXCEED students two and a half months

after the completion of the pilot program during the Fall 2012 semester. The questions and themed responses can be found in the Appendix B.

The top things that EXCEED students liked about the program were meeting people and making friends, industry tours and speakers, and the hands-on engineering group projects they completed. EXCEED students liked meeting peers who were experiencing the same transition to the university and who shared the same interests. They felt that these factors provided motivation to continue their engineering education at SJSU. Furthermore, many of the EXCEED students have since formed study groups with one another, which they felt was facilitated by being involved in the program. Study groups were described as “free tutoring” and students were grateful to have help with homework from other EXCEED students. Other students mentioned that it was a relief to have friends from the program in their classes, and felt that they would not have known anyone if they had not been involved in EXCEED. Students mentioned that a practical aspect of the program was that they did not get lost on the first week of school and felt happy to be able to help others not to get lost at our large metropolitan university. Overall, the students felt that the social connections formed in EXCEED provided an excellent support system. One student reported that he “thought that college would be very solitary, but [is] happy that it is not”.

The EXCEED students reported benefiting from the industry tours and guest speakers professionally and academically. They felt that both activities provided exposure to what one can do with the engineering education obtained at SJSU, as well as provided insight into new technologies and “how things work”. One student reported that meeting people in the engineering field might benefit her in the future to look for a job. Students felt that the engineering service learning group projects helped them in the following ways:

- Provided a hands-on, applied experience that was fun and interesting
- Provided feedback from professors that gave insight to college expectations
- Provided knowledge of engineering processes and procedures
- Something that can be put on their CVs
- Learned how to better serve the community and those in need
- Learned about group dynamics and how people work together
- Learned how teammate input can help with final product
- Helped them get to know others, to form friendships, was an icebreaker

Overall, EXCEED students had a positive experience with the five peer mentors due to their impressions that the peer mentors were approachable and provided honest information. They reported that peer mentors provided tips about how to enroll in classes, what to do before classes began, how to interact with faculty, and valuable tips on how to manage time. EXCEED students felt that the peer mentors were supportive and motivational. Due to the small age and

experience difference between peer mentors and first-year frosh, EXCEED students stated that the peer mentors could easily relate to their experiences in transitioning to college.

Conclusion

A ten day residential summer transition program was designed for incoming engineering freshmen. A pilot program was offered in August 2012 to thirty-two students. Activities in the program were formulated to acculturate the students to the College and University, build community amongst the students, enhance math and writing skills, enhance study skills, introduce the engineering design process, and expose them to different aspects of engineering. A core component of the program was a community based, service learning project used to introduce the students to engineering design principles, teamwork, project management, and communication. Assessment of how well the program met the outcomes and specific learning objectives was done in an electronic survey following the program and follow-up focus groups towards the end of their first semester. Students indicate the program was successful in meeting all of the objectives, particularly familiarizing students with the University, building community, and introducing students to the design process through the service learning project. Revisions of the math, writing, and study skills components are planned for the second pilot program to more closely integrate them with the engineering projects. The overall goal of using the summer transition program to impact retention of students in good academic standing is currently being assessed.

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Bibliography

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- ¹ Besterfield-Sacre, M., Atman, C., & Shuman, L. (1997). Characteristics of freshman engineering students: Models for determining student attrition in engineering. *Journal of Engineering Education*, 86(2): 139-150.
 - ² Kuh, G. D. (2008). *High-impact educational practices, What are they, who has access to them, and why they matter*. Washington, DC: AAC&U.

-
- ³ Brownell, J. E. & Swaner, L. E. (2010). *Five high-impact practices: Research on learning outcomes, completion, and quality*. Washington, DC: AAC&U.
- ⁴ May, G. S., & Chubin, D. E. (2003, January). A retrospective on undergraduate engineering success for underrepresented minority students. *Journal of Engineering Education*, 27-39.
- ⁵ Tinto, V. (2007). Classrooms as communities. *Journal of Higher Education*, 68(6): 599-623.
- ⁶ James, P. A., Bruch, P. L., & Jehangir, R. R. (2006). Ideas in practice: Building bridges in a multicultural learning community. *Journal of Developmental Education*, 29(3): 10-28.
- ⁷ Jehangir, R. (2008). In their own words: Voices of first-generation college students in a multicultural learning community. *Opportunity Matters*, 1, 22-32.
- ⁸ Yelamarthi, K. & Mawasha, P. R. (2008). A pre-engineering program for under-represented, low-income and/or first generation college students to pursue higher education, *Journal of STEM Education*, 9, 5-15.
- ⁹ Koenig, R. (2009) Minority retention rates in science are sore spots for most universities, *Science*, 324, 1386-1387.
- ¹⁰ Barefoot, B.O. (2005). *Achieving and sustaining institutional excellence for the first year of college*. San Francisco, CA: Jossey-Bass.
- ¹¹ Kuh, G. D., Kinzie, J., Schuh, J. H., & Whitt, E. J. (2005). *Student success in college: Creating conditions that matter*. San Francisco: Jossey-Bass
- ¹² Tinto, V. (2001). *Rethinking the first year of college*. Higher Education Monograph Series, Syracuse University.
- ¹³ Upcraft, M., Gardner, J., & Barefoot, B. (Eds.), (2004). *Challenging and Supporting the First-Year Student: A Handbook for Improving the First Year of College*. San Francisco: Jossey-Bass.
- ¹⁴ Cuseo, J. (2005). "Decided," "undecided," and "in transition": Implications for academic advisement, career counseling & student retention. In R.S. Feldman (Ed.). *Improving the first year of college: Research and practice*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers
- ¹⁵ Somers, P., Woodhouse, S., & Cofer, J. (2004). Pushing the boulder uphill: The persistence of first-generation college students. *NASPA Journal*, 41, 418-435.
- ¹⁶ Tinto, V. (2006-2007). Research and practice of student retention: What Next? *Journal of College Student Retention: Research, Theory & Practice*, 8(1), 1-19.
- ¹⁷ Pascarella, E. T., Pierson, C. T., Wolniak, G. C., & Terenzini, P. T. (2004). First-generation college students: Additional evidence on college experience and outcomes. *Journal of Higher Education*, 75, 249-284.
- ¹⁸ Walton, G. M., & Cohen, G. L. (2011, March 18). A brief social-belonging intervention improves academic and health outcomes of minority students. *Science*, 331, 1447-1451.
- ¹⁹ Zea, M., Reisen, C., Beil, C., & Caplan, R. (1997). Predicting intention to remain in college among ethnic minority and non-minority students. *Journal of Social Psychology*, 137, 149-160.
- ²⁰ Gonzalez, K. P., Olivas, L., & Callero, M. (2004). Enhancing the post-secondary experiences of Latinos. In L. I. Rendón, M. García, & D. Person (Eds.), *Transforming the first year of college of students of color* (pp. 109-122). Columbia, SC: National Resource Center for the First-Year Experience and Students in Transition.
- ²¹ Ruppert, S. R. (2003). *Closing the college participation gap: A national summary*. Denver, CO: Education Commission of the States.
- ²² Torres, V., Reiser, A., LePeau, L., Davis, L., & Ruder, J. (2006). A model of first generation Latino/a college students' approach to seeking academic information. *NACADA Journal*, 26(2), 65-70.
- ²³ Torres, V. (2006). A mixed method study testing data-model fit of a retention model for Latino students at urban universities. *Journal of College Student Development*, 47(3), 299-318.
- ²⁴ Nestor-Baker, N., & Kerka, S. (2009). *Recruitment and retention of underrepresented students in STEM Fields*. Columbus: The Ohio State University. Available: p12.osu.edu/documents/STEM_recruitment_retention.doc
- ²⁵ Astin, A. W. (1993). *What matters in college: Four critical years revisited*. San Francisco: Jossey-Bass.
- ²⁶ Kuh, G. D., Kinzie, J., Schih, J. H., & Whitt, E. J. (2005). *Student success in college: Creating conditions that matter*. San Francisco: Jossey-Bass.
- ²⁷ Engstrom, C. M., & Tinto, V. (2008). Learning better together: The impact of learning communities on the persistence of low-income students. *Opportunity Matters: A Journal of Research Informing Educational Opportunity and Practice*, 1, 5-21.
- ²⁸ Lardner, E. D. (2003). *Approaching diversity through learning communities*. Occasional Paper No. 2. Olympia, WA: Washington Center for Improving the Quality of Undergraduate Education, Evergreen State College.
- ²⁹ Freeman, K. E., Alston, S. R., & Winborne, D. G. (2008). Do learning communities enhance the quality of students' learning and motivation in STEM? *The Journal of Negro Education*, 77(3), 227-240.

- 30 Anderson, J. A. (2004). Academic and social integration: A key to first-year success for students of color. In L. I. Rendón, M. García, & D. Person (Eds.), *Transforming the first year of college of students of color* (pp. 77-89). Columbia, SC: National Resource Center for the First-Year Experience and Students in Transition.
- 31 Zhao, C., & Kuh, G. D. (2004). Adding value: Learning communities and student engagement. *Research in Higher Education*, 45(2), 115-138.
- 32 Engstrom, C., & Tinto, V. (2007). *Pathway to student success: The impact of learning communities on the success of academically under-prepared college students*. Syracuse, NY: Syracuse University.
- 33 Engstrom, C., & Tinto, V. (2008). Learning better together: The impact of learning communities on the persistence of low-income students. *Opportunity Matters: A Journal of Research Informing Educational Opportunity Practice and Programs*, 1(1), 5-21.
- 34 Petschauer, J. W., & Wallace, C. (2005). Engaging the first-year student. In R. S. Feldman (Ed.), *Improving the first year of college: Research and practice*. (Chapter 8). London: Psychology Press.
- 35 Moore, R. (2004). Do colleges identify or develop intelligence? *Journal of Developmental Education*, 28 (1), 28-34.
- 36 Giuliano, B., & Sullivan, J. (2007). Academic holism: Bridging the gap between high school and college. *American Secondary Education*, 35(3), 7-18.
- 37 Murphy, T. E., Gaughan, M., Hume, R., & Moore, S. G. (2010). College graduation rates for minority students in a selective technical university: Will participation in a summer bridge program contribute to success? *Educational Evaluation and Policy Analysis*, 32(1), 70-83.
- 38 May, G. S., & Chubin, D. E. (2003, January). A retrospective on undergraduate engineering success for underrepresented minority students. *Journal of Engineering Education*, 27-39.
- 39 Gilmer, T. C. (2007). An understanding of the improved grades, retention and graduation rates of STEM majors at the Academic Investment in Math and Science (AIMS) Program of Bowling Green State University (BGSU). *Journal of STEM Education*, 8(1&2), 11-21.
- 40 Crossing the bridge to STEM success. (2009, November). *NSTA Reports*, 21(3). Available: http://www.e3.uc.edu/resources/news/E3_National_Recognition.pdf
- 41 Muraskin, L., Lee, J., Wilner, A., & Swail, W. S. (2004). *Raising the graduation rates of low-income college students*. Washington, DC: Pell Institute for the Study of Opportunity in Higher Education.
- 42 Payne, G., & Dusenbury, R. H. (2007). An early intervention program for minority science students: Fall bridge program. *The International Journal of Learning*, 14(6), 23-27.
- 43 Russomanno, D., Best, R., Ivey, S., Haddock, J., Franceschetti, D., & Hairston, R. (2010). MemphiSTEP: A STEM talent expansion program at the University of Memphis. *Journal of STEM Education*, 11(1&2), 69-81.
- 44 Gilmer, T. C. (2007). An understanding of the improved grades, retention and graduation rates of STEM majors at the Academic Investment in Science (AIMS) Program at Bowling Green State University (BGSU). *Journal of STEM Education*, 8(1&2), 11-21.
- 45 Backer, P., & Wei, B. (2010, October). Work in progress-recruiting Hispanic students into computing through community service learning. In *Frontiers in Education Conference (FIE), 2010 IEEE* (pp. F4D-1). IEEE.
- 46 Tsang, E. (Ed.). (2000). *Projects that matter: Concepts and models for service-learning in engineering* (Vol. 5). Amer Assn for Higher Education.
- 47 Astin, A. W., Vogelgesang, L. J., Ikeda, E. K., & Yee, J. A. (2000). *How service learning affects students*. Los Angeles: Higher Education Research Institute, University of California.
- 48 Simons, L., & Cleary, B. (2006). The influence of service learning on students' personal and social development. *College Teaching*, 54(4), 307-319.
- 49 Steinke, P., & Buresh, S. (2002). Cognitive Outcomes of Service-Learning: Reviewing the Past and Glimpsing the Future. *Michigan Journal of Community Service Learning*, 8(2), 5-14.
- 50 Brainard, S. G., & Carlin, L. (1998). A Six-Year Longitudinal Study of Undergraduate Women in Engineering and Science. *Journal of Engineering Education*, 87(4), 369-375.
- 51 Cooke, R., Bewick, B. M., Barkham, M., Bradley, M., & Audin, K. (2006). Measuring, monitoring, and managing the psychological well-being of first year university students. *British Journal of Guidance & Counseling*, 34(4) 505-517.
- 52 Schreiner, L. A. & Anderson, E. (2005). Strengths-Based Advising: A new lens for higher education. *NACADA Journal*, 25(2), 20-29.

Appendix A: Freshmen Focus Group Questions

We are designing a 10 day summer transition program for incoming engineering frosh. We are designing content for it and are trying to get ideas of what would be most helpful for incoming students.

1. What were you most looking forward to with starting at SJSU?
2. What were you most anxious about with starting at SJSU?
3. What were some obstacles you faced upon arrival at the start of the semester?
4. What University resources did you use at SJSU your first semester?
 - a. How did you find out about those resources?
5. How do you interact with other SJSU students
 - a. In class?
 - b. Out of class?
 - c. With Student organizations?
 - d. What do you get out of these interactions (study groups, advice, social, etc...)?
6. How did you get help with your classes?
 - a. How do you study?
7. Looking back at your first semester, what do you wish you did differently?

Appendix B: Questions and Themes of Responses to EXCEED Focus Groups

1. Now that you are near the end of your first semester, what take away from the program has helped the most?
 - Meeting people who can collaborate as groups to do homework
 - Stop fearing engineering
 - Talking to professors
 - Finding resources, ESSC was helpful
 - Gave them a head start, knew about resources. Some experience communicating with faculty and professors
 - Knowing where everything was on campus
 - Getting acclimated to college life
 - Reviewing certain concepts was helpful
 - Gained higher sense of responsibility in managing a higher workload
 - Learned where good study spots are
 - Learned the in's and out's of housing
2. How can we improve the math component? Has your experience helped you in your classes this semester?
 - Should have been geared toward math 30 but not alienate math 19 students
 - Adding more calculus, good to brush up on math but also good to learn something new

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- Add more variety
 - Helped in E10 (Introduction to Engineering) class
 - Split into groups that pertain to them
 - Excel was helpful
 - Needs to be more challenging
3. How can we improve the writing component? Has your experience helped you in your classes this semester?
- Don't remember much from writing
 - Giving students the confidence to communicate with professors
 - More in class essay preparation during exceed program
 - Liked plagiarism section
 - More about technical writing to help with E10
 - Basic writing refreshment course
 - Learned the importance of writing structure
 - Include instruction on writing engineering reports
 - Feedback about writing was helpful
4. Do you think you utilize the content of the Strengthquest and time management workshops this semester?
- Didn't use Strengthquest
 - Helps figure out your own strengths
 - More self assurance
 - Strength quest helped him understand other people's personality, understand the decisions their perspective which makes it easier to relate
 - Remember that focusing on strengths it helps improve rather than focusing on weaknesses
 - Did not like the measure, suggested
 - Time management was helpful, help establish student schedule
 - Use a calendar to keep track of schedule
 - Would like for the time management to go more in depth and plan hour by hour (Veronica gave them the handout, but they did not establish an hour by hour schedule at the workshop)
 - Adding a testing skills or study skills
 - Guest speakers provided insight on health, where to go for tutoring
5. The surveys mentioned more information about engineering majors. How should we present this to next year's group?
- What kind of career they can pursue after graduating, going over all major in detail
 - Talk about difference between departments/majors

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- A general idea what other majors does and how they contribute to the industry
 - Invite engineering student ambassadors who are in the major to speak about their experience and what they look forward to.
 - More hands on activity that relates to the major for students to try out
 - Guest speakers: content tied to each concentration
 - Perhaps seminar structure with faculty and student presenters
6. How could we structure the program better?
- The timeline for the project was a little short
 - Like how it's flexible and not too structured
 - Tempo was good, a lot was done
 - Adding one more day for completing the project
 - 10 day structure was ok
 - Starting on Wednesday was fine
 - 4 to 5 hour blocks was great and helpful
 - 4 to 5 hour blocks were not good because students started goofing off
 - Going to 9pm was ok
 - Rather get the project done and not have it finish a month later
 - 10 days is good, helps form friendship better than 5 days
 - More down time when starting off
 - More time to finish project or making smaller scale project
 - Bring in more activities to get to know others before starting (ice breakers)
 - Visiting hours for family
 - Confused about move in day to live on campus
 - Emphasize project more on the first day (orientation) so that students know it is a major part of the program
 - Liked flexibility to go to (soccer game, doctor apt., exam, etc.)
7. What are some obstacles you faced this semester and how did EXCEED help you face them or what could we do to help you prepare for these obstacles?
- Preparing students to motivate themselves and utilize the tools provided
 - Knowing what resources are out there help get students through
 - Giving them free time was good and they would utilize it to do their work. They realize that if they wanted to succeed they needed to utilize that free time.
 - Time management helped structure a schedule
 - Getting to know the campus layout helped with finding way around buildings
 - Would like more scheduling help before school starts
 - Math trouble, was great to know other students and get help
 - Not getting lost
 - Transportation

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- Liked faculty assistance, know they are here to help
 - Peer Mentor advice about classes

EXCEED students became involved in a wide range of activities and organizations in their first semester, including:

- Engineering student organizations related to interests and/or majors of study
- Student chapters of professional societies (i.e., Society of Women Engineers)
- Outreach organizations (i.e., Engineering Ambassador Program)
- Cultural or ethnic clubs and organizations (i.e., Filipino club)
- Political interest groups (i.e., Students for Quality Education)
- Sports teams (i.e., Soccer, intramurals)
- On-campus jobs (i.e., Orientation Leader)
- Community Service groups
- Spiritual / Faith-based groups

EXCEED students utilized various SJSU services in their first semester, such as:

- Peer connections
- Library
- ESSC
- Advisor
- Writing center
- Faculty office hours
- Cell
- Tech workshops
- Student Union
- Computer Labs
- Print shop
- ESSC Advising

EXCEED students provided feedback on how to improve the program:

- Healthier food and snacks, more opportunities for physical activity and exercise
- Start project earlier, with shorter time blocks
- Well rounded diversity
- Have previous EXCEED participants serve as peer mentors for next year's program
- Staying connected: Bring everyone back for get together once or twice semester
- Stress "Don't be afraid/shy to ask for help"