

Building Bridges
From the Community College to a University Engineering
Education
A Model for Collaborative Approach

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Abstract

Salt Lake Community College's Engineering Department and the four-year institutions of higher education in the state of Utah are involved in a unique educational partnership. Salt Lake Community College (SLCC) students transfer to the University of Utah (U of U), Utah State University, Weber State University and Brigham Young University – all of which provide ABET accredited engineering and/or engineering technology programs. SLCC's Engineering Department offers associate degrees in Chemical, Civil, Computer-Engineering, Electrical, Manufacturing, Materials Science, Metallurgical, and Mechanical Engineering.

The majority of the SLCC transfer students move from SLCC to the U of U, College of Engineering. The U of U, College of Engineering includes seven departments (Bioengineering, Chemical Engineering, Civil and Environmental Engineering, Electrical and Computer Engineering, Materials Science and Engineering, Mechanical Engineering, and School of Computing) and three programs (Computing Engineering, Environmental Engineering, and Nuclear Engineering), over 2,200 undergraduate students and over 700 graduate students. The College accounts for approximately 10% of the student population at the U of U. SLCC, one of the largest metropolitan community colleges in the country, serves over 60,000 credit and non-credit students. The College's Engineering Department prepares over 300 students for transfer to the U of U. During the last twenty years the two Institutions have developed a well-articulated program allowing engineering students from SLCC's various engineering programs to seamlessly transfer into the U of U's engineering departments. In addition, this articulation allows U of U's students to take advantage of summer and evening offerings at SLCC. The relationship between the two Colleges has been successful because of strong faculty ties, aggressive institutional support, and mutual respect.

Approximately 40% of the first time students at the U of U, College of Engineering, are transfer students, with the majority of those coming from SLCC. This presentation will examine: the unique challenges of preparing community college students for seamless transitions into the U of U and for academic success

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in the engineering programs at the U of U; the role of the Community College and the role of the University in facilitating the transition from the two year environment to a research University; the collaborative efforts of the faculty and staff for the formulation of a successful 2+2 articulated program; and the different environmental factors which exist at the two institutions and how they affect students. This process could be used as a model for national and international 2+2 engineering programs. Successes and challenges are evaluated, and future areas of collaboration are described.

I. Introduction

A. About Salt Lake Community College

Salt Lake Community College (SLCC) is a large metropolitan community college, surrounded by rural communities, with an overall budget of nearly \$70,000,000 per year. SLCC consists of four campuses, and five teaching centers, for a total of nine locations within the Salt Lake City, Utah area. There are approximately 14,000 full-time equivalent (FTE) students, and 24,000 actual student head count. This number includes approximately 3,200 skill center students. Students attending SLCC take credit courses as well as non-credit courses. Students complete Associate of Engineering Degrees, Associate of Science Degrees, Associate of Applied Science Degrees, diplomas, and certificates in a variety of specialty areas. The majority of our students complete transfer programs and continue their educational studies at four year colleges and universities, while some complete their education at SLCC and go directly into their chosen profession.

B. About the University of Utah

The University of Utah is a leading public and teaching institution with diverse disciplines for both undergraduate and graduate students. The University is accredited by the Northwest Associate of Schools and Colleges and is classified as one of 50 comprehensive public Research I universities. Total Fall 2003 enrollment was approximately 28,440 students with a residential population of over 90% and undergraduates accounting for almost 79% of the student population. The University considers itself a commuter campus with only some 2,500 students living on campus. Students enrolled from all 29 Utah counties, all 50 states, and more than 100 foreign countries. The University is one of the major employers in the state with over 18,000 part-time and full-time employees. There are 15 colleges at the University and over 70 undergraduate-level majors and more than 90 majors for graduate students.

II. History

A. Salt Lake Community College

Salt Lake Community College was founded in 1948 as a technical/vocational school. Originally named Utah Technical College, it was located in downtown Salt Lake City in a former horse stable. The first student body consisted of 148 students, mainly WW II veterans, who attended classes such as automotive maintenance and body and fender repair. The offerings were gradually increased, and expanded from a vocational/technical emphasis to include general education courses such as freshman English and basic mathematics. On March 16, 1967, the campus moved to its current location on Redwood Road and soon changed its name to Salt Lake Community College (SLCC). This was announced by Utah Technical College as "Operation Big Move". Although SLCC still offers a wide range of vocational/technical training, over 70% of the students are enrolled in transfer programs. Formal articulation agreements are in place with all of Utah's public institutions. In addition, students regularly transfer to private colleges (primarily Brigham Young University and Westminster College) where their transcripts are evaluated on an individual basis.

B. University of Utah

The University of Utah was opened as the University of Desert in 1850 at a location on the southwest corner of Main and South Temple Streets (Gehmlich, 2003). In 1891, departments at the University were reorganized and added, totaling nine, including mining and mining engineering. The name of the school was changed in 1892 to the University of Utah. At that time, the only engineering degree awarded was one in Mining Engineering, with course work in Civil and Mining Engineering. Electrical Engineering was announced as a major in the 1898-99 catalog and the next year, 1900, the move was made to the present campus. By 1905, in addition to mining, electrical, civil, and mechanical engineering, courses in chemical engineering were added to the established School of Mines. In 1917 the name was changed to the School of Mines and Engineering. In 1946, the two schools were separated and the School of Engineering was formed with four departments: Civil, Chemical, Electrical, and Mechanical. In the mid-1960's Bioengineering, Materials Science and Engineering, and Computer Science were added. The programs in Civil, Chemical, Electrical, Mechanical and Computer Engineering and Material Science and Engineering all hold ABET accredited programs. The Undergraduate program in Biomedical Engineering is a relatively new program which will move forward with accreditation within the next few years.

III. Student Institutional Profiles

Table 1 illustrates the Student Profiles of the two institutions. It should be noted that SLCC also provides training for local companies and operates an extensive concurrent enrollment program with public school districts in the Salt Lake valley. When those students are considered, SLCC serves over 60,000 students each year, making SLCC the second largest public institution of higher education in Utah. (See Table 1) The data in Table 1 reflect credit bearing classes.

Table 1		
STUDENTBODY PROFILE		
(Based on Fall Semester 2002 for SLCC* and Fall 2003 for UofU)		
	Salt Lake Community College	University of Utah
Student Headcount	23,154	28,437
Male/Female	52/48%	55/45%
Utah Residents	94%	90.4%
Undergraduate/Graduate	N/A	78.8/21.1%
Percentage of White students	88%	84%
Student to faculty ratio	20 to 1	15 to 1 for UG
Number of graduates	2,776	BS - 4,488 MS - 1,129 PhD - 470
Average Student Age	26	24 (2002 data and for UG only)
Percentage of first time students transfers	N/A	44.8%

* From SLCC 2003-2004 Catalog

IV. Engineering Departments

The Engineering Departments at SLCC enjoy one of the best articulation agreements with the outstanding universities within the State. Students beginning their engineering education at SLCC can transfer with no loss of credit, to complete their education. All SLCC engineering departments enjoy articulation agreements, with four-year colleges and universities within the State of Utah.

A. History

SLCC's Engineering program was initiated in 1985. In 1985 the Utah Board of Regents approved the Associate of Pre-Engineering degree (APE). Most associate degrees offered by SLCC meet the general education requirements for a

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four year degree at a transfer institution. However, because engineering programs emphasize basic mathematics, science and engineering during the first two years, there is insufficient room in the schedule to complete general education requirements, which are usually put off until the junior and senior year. Thus, SLCC's engineering APE degree is designed with the intention that students complete general education requirements at the senior institution, or remain at SLCC for additional course work.

B. Demographics

At the University of Utah, the College of Engineering, has approximately 120 faculty and a student population of approximately 2200 undergraduates and 710 graduate students (2002 data), for a total of 2910 students. Just over 12% of the undergraduates are female and almost 17% of the graduate population is female. Utah students account for about 81% of the population and of the first time class just over 40% are transfer students. The demographics of the engineering program at SLCC roughly parallel the SLCC college wide demographics, expect for female and minority enrollment. Enrolling women and minorities in engineering in particular, and math and science in general, continues to be a problem for both institutions. Efforts to recruit women and minorities are underway and include: visits to local high schools, involvement in groups such as MESA, and outreach programs held on the campuses of the two institutions. However enrollment data has not shown any significant changes in the last five years. The average community college student is older than the average university student.

Minorities constitute 11.3% of the SLCC college student enrollment for the 2002-2003 academic year. The students' mean college age is 25.8 years old. The median age for students college wide is 23.3 years old. The overall/college wide percentages of male and female student enrollments for SLCC are shown below. The figure for female enrollment at 48% is lower than the recent national average which shows female enrollment at around 60%. As expected, the Engineering Department has an even lower percentage of female enrollment than the SLCC college wide figure of 48%.

<u>SLCC College wide 2002-2003</u>		<u>Engineering Department 2002-</u>	
<u>2003</u>			
<u>Female</u>	<u>Male</u>	<u>Female</u>	<u>Male</u>
48%	52%	10%	90%

C. Engineering Programs

In February of 1985, the first "Pre-Engineering Education in Utah" workshop was held on the University of Utah campus, co-sponsored by the State Board of Regents, the University of Utah, Utah State University, and Brigham

Young University (Gehmlich, 2003). Encouraged by the success of this workshop and the commitment to aid in the transfer of students from pre-engineering programs to the Universities, a Pre-Engineering committee was formed. The first meeting was held in 1986, with the commitment to hold yearly workshops to review course content and articulate curricula. Even though the people on the committee have changed many times, the committee continues to function with twice a year meetings. In this fashion, strong articulation agreements exist, particularly between the University of Utah and SLCC.

In addition to state-wide meetings, SLCC hosts two Program Advisory Committee (PAC) meetings each year. One meeting is usually held Fall semester and one in the Spring semester. Representatives from local businesses and past SLCC graduates also attend. Typically the engineering advisor from Utah State, and department representatives from the University of Utah attend. Problems are ironed out at the meeting, which also gives faculty the opportunity to discuss upcoming program changes and concerns.

Currently, SLCC offers eight different engineering options for APE degree candidates (Table 2).

Table 2 SLCC Engineering Programs		
Program	Semester Credits Required for APE Degree	Number of Classes Offered in this Subject Area
• Chemical Engineering	67 minimum	4
• Civil and Environmental Engineering	75.5 minimum	14=12+1+1 includes; EE for civil majors and MSE for civil majors
• Computer Science Engineering	66.5 minimum	7 Also Draws from Electrical Engineering and Computer Science
• Electrical Engineering	70.5 minimum	12
• Manufacturing Engineering	67 minimum	None needed that are unique to Manufacturing
• Materials Science Engineering	71 minimum	7
• Mechanical Engineering	72 minimum	12=10+1+1 includes; EE for civil majors and MSE for civil majors
• Metallurgical Engineering (proposed)	69 minimum	None needed that are unique to Metallurgy

The course work in these programs is designed for most part to mirror the first two years of course work at 4 year institutions – primarily the University of Utah. Tables 3 through 10 show the course work and the number of credits for each semester for the various APE Degrees for each of the engineering programs at SLCC.

Table 3
Chemical Engineering Plan of Study – Salt Lake Community College

First Fall Semester			First Spring Semester		
Chemistry I	CHEM 1210	4	Chemistry II	CHEM 1220	4
Chemistry Lab	CHEM 1230	1	Chemistry Lab II	CHEM 1240	1
English I	ENGL 1010	3	English II or Technical Writing	ENGL 2010 Or ENGL 2100	3
Calculus I	MATH 1210	4	Calculus II	MATH 1220	4
Engineering Computing	CS 1050	3	Engineering Physics I - Mechanics	PHY 2210	4
Total		15	Physics I Lab	PHY 2230	1
			Total		17
Second Fall Semester			Second Spring Semester		
Statics	CEEN 1300	3	Numerical Methods	CEEN 2040	2
Thermodynamics	CHE 2850	2	Strength of Materials	CEEN 2310	2
Organics Chemistry I	CHEM 2310	4	Strength of Materials Lab	CEEN 2330	1
Organic Chemistry Lab	CHEM 2330	1	Process Engineering	CHE 2800	3
Engineering Physics II - Electricity and Magnetism	PHY 2220	4	General Education	Variety of Options	6
Physics II Lab	PHY 2240	1	American Institutions		3
Differential Equations	MATH 2250	3	Total		17
Total		18			

***All the courses above are articulated to the University of Utah and Utah State University**

**Table 4
Civil Engineering Plan of Study – Salt Lake Community College**

First Fall Semester			First Spring Semester		
Chemistry I	CHEM 1210	4	Chemistry II	CHEM 1220	4
Chemistry Lab	CHEM 1230	1	Chemistry Lab II	CHEM 1240	1
English I	ENGL 1010	3	English II or Technical Writing	ENGL 2010 Or ENGL 2100	3
Calculus I	MATH 1210	4	Calculus II	MATH 1220	4
Engineering Physics I - Mechanics	PHY 2210	4	Engineering Computing	CS 1050	3
General Education		3	Statics	CEEN 1300	3
Total		19	Total		18
Second Fall Semester			Second Spring Semester		
Civil Engineering Design	CEEN 1100	3	Drafting – AutoCad	Arch 1310	3
Strength of Materials I	CEEN 2310	2	Surveying	CEEN 2030	3
Strength of Materials Lab	CEEN 2330	1	Engineering Economics	CEEN 2130	3
Dynamics I	CEEN 2340	2	Structural Theory	CEEN 2410	3
Electrical Engineering or Materials Science Engineering	EE 1060 or MSE 2170	1.5	Thermodynamics	CHE 2850	2
Differential Equations	MATH 2250	3	Calculus III	MATH 2210	3
American Institutions	Variety of choices	3	General Education		3
General Education		3	Total		20
Total		18.5			

***All the courses above are articulated to the University of Utah and Utah State University**

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**Table 5
Computer Science Engineering Plan of Study – Salt Lake Community
College**

First Fall Semester			First Spring Semester		
Engineering Computing or CS 0	CS 1050 Or CS 1400	3	Computer Science I	CS 1810	4
English I	ENGL 1010	3	Unix Fundamentals	EE 1030	0.5
Calculus I	MATH 1210	4	English II or Technical Writing	ENGL 2100 Or ENGL 2010	3
Engineering Physics I - Mechanics	PHY 2210	4	Calculus II	MATH 1220	4
American Institutions		3	Engineering Physics II – Electricity and Magnetism	PHY 2220	4
Total		17	Total		15.5
Second Fall Semester			Second Spring Semester		
Computer Science II	CS 1820	4	Computer Architecture	CS 2620	4
Digital System Design	CS 2610	4	Discrete Structures	CS 2310	3
Chemistry I	CHEM 1210	4	Differential Equations	MATH 2250	3
Calculus III	MATH 2210	3	General Education		6
General Education		3	Total		16
Total		18			

***All the courses above are articulated to the University of Utah and Utah State University**

Table 6
Electrical Engineering Plan of Study – Salt Lake Community College

First Fall Semester			First Spring Semester		
Chemistry I	CHEM 1210	4	MATLAB	EE1020	1
Chemistry Lab	CHEM 1230	1	C++ Programming	CS 1600	4
English I	ENGL 1010	3	English II or Technical Writing	ENGL 2100 Or ENGL 2010	3
Calculus I	MATH 1210	4	Calculus II	MATH 1220	4
Unix Fundamentals	EE 1030	0.5	Engineering Physics I - Mechanics	PHY 2210	4
General Education		3	Physics I Lab	PHY 2230	1
Total		15.5	Total		17
Second Fall Semester			Second Spring Semester		
Thermodynamics	CHE 2850	2	Electrical Circuits	EE 2050	4
Lab Instrumentation and Methods	EE 1010	1	Intro to EE	EE 2100	4
Electrical Circuits	EE 1100	4	Digital Systems	EE2700	4
Engineering Physics II – Electricity and Magnetism	PHY 2220	4	Calculus III	MATH 2210	3
Differential Equations	MATH 2250	3	General Education		3
American Institutions	Variety of choices	3	Total		18
General Education		3			
Total		20			

***All the courses above are articulated to the University of Utah and Utah State University**

**Table 7
Manufacturing Engineering Plan of Study – Salt Lake Community
College**

First Fall Semester			First Spring Semester		
Chemistry I	CHEM 1210	4	Chemistry II	CHEM 1220	4
Chemistry Lab	CHEM 1230	1	Chemistry Lab II	CHEM 1240	1
Calculus I	MATH 1210	4	Engineering Physics II – Electricity and Magnetism	PHY 2220	4
Engineering Physics - Mechanics	PHY 2210	4	Physics II Lab	PHY 2240	1
Physics Lab	PHY 2230	1	Calculus II	MATH 1220	4
Delphi Programming	CS 1500	3	Engineering Computing	CS 1050	3
Total		17	Total		17
Second Fall Semester			Second Spring Semester		
Statics	CEEN 1300	3	Numerical Techniques	CEEN 2040	2
CS I	CS 1810	4	English II or Technical Writing	ENGL 2010 or ENGL 2100	3
English I	ENGL 1010	3	Differential Equations	MATH 2250	3
Calculus III	MATH 2210	3	General Education		9
American Institutions	Variety of choices	3	Total		17
Total		16			

***All the courses above are articulated to the University of Utah and Utah State University**

**Table 8
Materials Science Engineering Plan of Study – Salt Lake Community
College**

First Fall Semester			First Spring Semester		
Chemistry I	CHEM 1210	4	Chemistry II	CHEM 1220	4
Chemistry Lab	CHEM 1230	1	Chemistry II Lab	CHEM 1240	1
Calculus I	MATH 1210	4	English I	ENGL 1010	3
Engineering Physics I - Mechanics	PHY 2210	4	Calculus II	MATH 1220	4
Physics I Lab	PHY 2230	1	Engineering Physics II – Electricity and Magnetism	PHY 2220	4
Engineering Computing	CS 1050	3			
Total		17			
			Total		16
Second Fall Semester			Second Spring Semester		
Statics	CEEN 1300	3	Strength of Materials	CEEN 2310	2
Organic Chemistry I	CHEM 2310	4	Electrical Engineering	EE 1050	3
English II or Technical Writing	ENGL 2010 or ENGL 2100	3	Polymer Engineering	MSE 2410	2
Materials Science Engineering	MSE 2010	4	Electronic Materials	MSE 2210	2
Calculus III	MATH 2210	3	Differential Equations	MATH 2250	3
American Institutions		3	General Education		6
Total		20	Total		18

***All the courses above are articulated to the University of Utah and Utah State University**

**Table 9
Metallurgical Engineering Plan of Study – Salt Lake Community
College**

First Fall Semester			First Spring Semester		
Chemistry I	CHEM 1210	4	Chemistry II	CHEM 1220	4
Chemistry Lab	CHEM 1230	1	Chemistry Lab II	CHEM 1240	1
English I	ENGL 1010	3	English II or Technical Writing	ENGL 2010 Or ENGL 2100	3
Calculus I	MATH 1210	4	Calculus II	MATH 1220	4
Engineering Computing	CS 1050	3	Engineering Physics I - Mechanics	PHY 2210	4
General Education		3	Physics Lab	PHY 2230	1
Total		18	Total		17
Second Fall Semester			Second Spring Semester		
Statics	CEEN 1300	3	Calculus III	MATH 2210	3
Thermodynamics	CHE 2850	2	Strength of Materials	CEEN 2310	2
Organics Chemistry I	CHEM 2310	4	Strength of Materials Lab	CEEN 2330	1
Organic Chemistry Lab	CHEM 2330	1	Process Engineering	CHE 2800	3
Engineering Physics II - Electricity and Magnetism	PHY 2220	4	General Education	Variety of Options	3
Physics II Lab	PHY 2240	1	American Institutions		3
Differential Equations	MATH 2250	3	Total		18
Total		18			

***All the courses above are articulated to the University of Utah and Utah State University**

**Table 10
Mechanical Engineering Plan of Study – Salt Lake Community
College**

First Fall Semester			First Spring Semester		
Chemistry I	CHEM 1210	4	Statics	MEEN 1300	3
Chemistry Lab	CHEM 1230	1	English II or Technical Writing	ENGL 2010 Or ENGL 2100	3
English I	ENGL 1010	3	Calculus II	MATH 1220	4
Calculus I	MATH 1210	4	Engineering Physics II – Electricity and Magnetism	PHY 2220	4
Engineering Physics I - Mechanics	PHY 2210	4	American Institutions	Variety of Choices	3
Design and Visual Communication	MEEN 1050	3	Total		17
Total		19			
Second Fall Semester			Second Spring Semester		
Thermodynamics	CHE 2850	2	Electrical Engineering	EE 1050	3
Strength of Materials I	MEEN 2310	2	Numerical Techniques	MEEN 2040	2
Strength of Materials Lab	MEEN 2330	1	Manufacturing	MEEN 2050	4
Dynamics I	MEEN 2340	2	Dynamics II	MEEN 2350	2
Materials Science Engineering	MSE 2160	3	Calculus III	MATH 2210	3
Differential Equations	MATH 2250	3	General Education		3
Engineering Computing	CS 1050	3	Total		17
General Education		3			
Total		19			

***All the courses above are articulated to the University of Utah and Utah State University**

D. Engineering Students by Major

Table 11 illustrates the count of students and their majors since Fall 2002 semester at SLCC. This data gives an overall picture of students who registered in each of the engineering programs. There is always a possibility of students changing major which is normal as they progress through their college education.

Table 11

Major	Fall 2002	Spring 2003	Fall 2003
Chemical Engineering	20	21	15
Civil/Environmental Engineering	61	75	98
Computer Engineering	33	29	31
Electrical Engineering	52	68	92
Manufacturing Engineering	12	19	38
Materials Science Engineering	3	5	3
Mechanical Engineering	58	59	44

V. Diversity of Courses

At first the task of offering course work in 8 different engineering disciplines for a limited number of students seems infeasible. However, the first two years of study is very similar across the engineering spectrum. All engineering students require a rigorous preparation in mathematics and basic science. They share courses with students from Chemistry, Physics and Biological Science programs in:

Calculus I – Differentiation Techniques
Calculus II – Integration Techniques
Calculus III – Multivariate Calculus
Differential Equations and Linear Algebra
Chemistry I and II
Physics I – Calculus based Mechanics
Physics II – Calculus based Electricity and Magnetism

All of these courses are offered every semester (including summer) both during the day and in the evening.

In addition, the engineering programs can be grouped into two basic areas for the first two years – programs that emphasize mechanics, and programs that emphasize electrical and computer science concepts.

Mechanical Concepts

Civil Engineering
Mechanical Engineering
Chemical Engineering
Materials Science Engineering
Metallurgical Engineering

Electrical and Computer Concepts

Electrical Engineering
Computer Engineering

This results in large enough student populations to offer most basic courses every semester

Mechanical Concepts

Statics
Majors
Strengths of Materials
Dynamics I and II
Thermodynamics
Materials Science Engineering
Surveying
Civil Engineering Design

Electrical and Computer Concepts

Electrical Engineering for Non-
Engineering Computing
Electrical Circuits
Computer Architecture
C++ Programming
JAVA Programming
Numerical Methods

Mechanical Engineering Design

At the University of Utah, Statics and Strengths of Materials is combined into a semester course in the Mechanical Engineering Department, while the Civil Engineering Department teaches Statics and Strengths of Materials as two separate courses. Dynamics I and Dynamics II are combined into a one semester course in the Mechanical Engineering Department at the University of Utah. Teaching each of these subjects as independent courses at SLCC allows students from both departments to study together, and to take just the course work appropriate to their major, while creating sections large enough to offer every semester.

During the last three years the student population has grown enough to allow most of these courses to be offered at SLCC both during the day and at least once each year in the evening. A minimum of ten students is required to initiate an evening offering. Although lower than the institution minimum class size of 15, SLCC has allowed these smaller classes as a way to promote the evening program. As a community college, the mission of SLCC includes reaching out to working citizens, and evening offerings enhance that goal. Without exception, the enrollment in evening sections has grown, once the community has become aware of them. A similar approach has been taken with summer offerings. Introduction to Materials Science was offered for the first time during the summer in 2000, to 6

students. That grew to 10 in 2001, 12 in 2002 and 24 in 2003. Thermodynamics also saw a growth from 10 students in 2000 to 28 during the summer of 2003.

The remaining course work which is very specific to a single major, can be offered to smaller groups of students once each year. This grouping allows students to progress through the material in individualized plans of study – an approach made necessary because of the wide variety of preparation found in community college students.

The community college is able to teach classes with modest enrollments because of a very different approach to faculty work load than a university. SLCC faculty are required to teach a minimum of 15 semester credits each semester. Unlike their university counterparts, they do not perform research as part of their regular college duties. Most engineering faculty teach an additional course past the 15 credit minimum, in order to allow additional sections to be covered. They also regularly teach during the summer semester. The department uses very few adjunct faculty for a number of reasons. Appropriately qualified engineering faculty are difficult to find and the pay schedule is unattractive. However, the most important reason is that full-time faculty are committed to providing a consistent level of instruction. Since community college students will transfer to a demanding university program, it is imperative that all SLCC engineering students receive a consistently rigorous level of instruction. It is critical to our relationship with the University of Utah that faculty at the University know that our students are well prepared, whether they took a class during the regular day program, during the evening or during the summer. In the past, when SLCC faculty have given up control to adjunct faculty, the results have been mixed.

VI. Preparation in Mathematics and English

Students at SLCC range from the 18 year old recent high school graduate, to returned missionaries (a significant fraction of the student body serves two year LDS missions after entering college), to middle aged “retreads” who are preparing for a new career. Because of their broad range of preparation, all entering students are required to take placement examinations in both English and Mathematics. Recent ACT or SAT scores may be submitted in place of these tests. Since proficiency in mathematics is critical to engineering students, mathematics placement tends to control a student’s progress through the engineering programs. English proficiency, although important to engineers, is not a prerequisite to engineering classes.

The mathematics placement data specifically for Engineering students was not available, however anecdotal evidence suggests that engineering students score higher in general. Many successful engineering students at SLCC begin their college math study in developmental math programs (MATH 99 or below).

Figure 1 shows four current students who started in developmental math programs and successfully completed ordinary differential equations and Calculus III.



Joel Dimick started

Figure 1 – Successful Mathematics Students Who Started in Developmental Math

Because math remediation limits the number of engineering courses for which students can initially register, most complete their general education requirements for both the 2 year and 4 year degree at SLCC before beginning the core engineering program. The University of Utah requires an additional general education course in a diversity content area, which is completed during the junior or senior years.

VII. How do we keep the programs Coordinated?

In 1986 the Utah State Board of Regents mandated that four year institutions must accept an associate of science degree from any state school, as completion of the general education requirements at the senior institution. The Board of Regents also instituted the creation of statewide articulation teams in all subject areas, who were tasked with setting course standards so that courses could be transferred between institutions within the state. This goal was not a request, but was a mandate from the state. These articulation teams have experienced different levels of success. Strong articulation and coordination of programs already existed in the state's academic Engineering community, and Engineering programs have consistently been touted as a model of cooperation. At least once each year representatives of all the state schools with Engineering programs meet to discuss articulation issues.

Although both Utah State and the University of Utah have large transfer populations, the most popular transfer program is from SLCC to the University of Utah. Part of the reason for this popularity is that 1.8 million of the state's 2

million inhabitants, live within easy commuting distance of both institutions. The other state institutions (except for Utah Valley State College) are all located in rural areas of the state. Proximity of SLCC and the U of U to the same large population source, makes it natural for the two institutions to cooperate. To keep SLCC programs coordinated with both Utah State and the University of Utah, SLCC hosts two Program Advisory Committee (PAC) meetings each year. The meetings are usually held once in Fall semester and once in the Spring semester. Representatives from local businesses and past SLCC graduates also attend.

Typically the engineering advisor from Utah State, and department representatives from the University of Utah attend. Problems are ironed out at the meeting, which also gives faculty the opportunity to discuss upcoming program changes and concerns.

Official meetings ensure that at least twice a year faculty at SLCC talk to their counterparts at the University of Utah. However, the real strength of the program lies in the personal relationships forged between faculty members from the two institutions. Faculty from the University of Utah are often guest speakers in classroom presentations. They host annual transfer workshops, and invite students to participate in student activities such as ASCE (American Society of Civil Engineers) or ASME (American Society of Mechanical Engineers). University faculty make community college students feel welcome at the senior institution, and often advise their native students to take an occasional course at the community college in the summer or in the evening. Community college

imperative to making this program work effectively. Part of that respect involves understanding the difference between the missions of the two institutions and the value of those differences. At SLCC the emphasis is on nurturing – to provide opportunity for students to overcome their preparation deficiencies which might be hampering their progress toward an engineering degree. At the University of Utah, the emphasis is on providing opportunities for students to explore and expand their learning opportunities through research projects, specialized labs, etc. SLCC students, no matter what their preparation was when they arrive, should be able to compete with university students and to take advantage of the opportunities at a research institution like the University of Utah

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Biographies

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DR. HOLLY MOORE

Holly earned a BS in Chemistry and an MS in Chemical Engineering from S.D. School of Mines and Technology, and a Ph.D. in Chemical Engineering from the University of Utah. She worked for Dow Chemical Company, and Hercules Aerospace Corporation, before joining Salt Lake Community College in 1990. She currently teaches Engineering Computing, Thermodynamics, Materials Science Engineering and Process Engineering courses.

DR. NICK M. SAFAI

Professor **Safai** has been the Head of the Engineering Department at SLCC. He received his Ph.D. in Engineering from Princeton University in 1977, and MSE in Aerospace and Mechanical Engineering in 1974, MSE in Civil Engineering in 1975, and MSE in Petroleum Reservoir Engineering in 1975 all from Princeton University. He holds a B.S. in Mechanical Engineering from Michigan in 1972. Prior to joining the academics, Dr. Safai worked in industry, where he served as Director of the Reservoir Engineering Division at Chevron Oil Corporation in California. He has performed research projects for the Department of Energy (DOE), Department of Defense (DOD), National Science Foundation (NSF) and the Oil Industry. He had authored over 45 technical publications in technical journals, government & industry project reports. His research interests include; 3-D multi-phase flow through porous media, wave propagation in filamentary composite materials, stress concentrations, 3-D explicit-implicit finite element, finite difference mathematical modeling of fluid reservoirs, and directional drilling.

He is a member of several engineering societies including American Society of Engineering Education (ASEE). He was elected and has served as the Chair of ASEE Annual Conference Programs for the past four years, a reviewer & session Chair for ASEE for the past 14 years. He is also Chapter Chair for ASCE & a member of ASME.

DR. DAVID RICHARDSON

He is Vice President of Academic Services at SLCC. He holds a Ph.D. in Chemistry from Utah State University. He has a masters degree from Purdue University and a baccalaureate degree from Oakwood College. Before assuming a role in administration, his research interest was in magnetic resonance spectroscopy. He has been at SLCC since 1992. Previously, he was Provost at the Moreno Valley Campus of Riverside Community College.

DR. JOANN S. LIGHTY

Professor JoAnn Slama Lighty is Professor of Chemical Engineering and Associate Dean of Academic Affairs at the University of Utah. She has been a faculty member at Utah since 1988. Over the last 9 years she has been involved in the recruitment and retention of undergraduate engineering students and has implemented several outreach programs. She was appointed by Former Gov. Leavett to serve on the Board of Trustees for the Academy of Math, Engineering, and Science, a new charter school emphasizing science and engineering (2002). She served as past Chair of the Presidential Commission on the Status of women and in 2002 she received the Linda K. Amos Award for Distinguished Service to Women. In November 2003, she organized an NSF-sponsored conference, under the ADVANCE program, on Women in Engineering Leadership with some 50 participants and speakers.

She is actively involved in several professional and has also served on the Environmental Protection Agency's Science Advisory Board, Environmental Engineering Committee. She has over 35 peer-reviewed, technical publications and 75 presentations in her area of expertise, combustion and air pollution.