

**Universal Model - A Partnership for an Accelerated Civil
Engineering Program
Bridging the Civil Engineering Education from the Community
College to a University**

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Abstract

Currently there is an initiative in progress to develop a (three semester) year round program of study that will allow students to complete their Bachelor of Science in Civil Engineering (BSCE) degrees in a shorter time frame. This initiative is requiring the integration of Salt Lake Community College (SLCC) course offerings with those at the University of Utah (UoU). The large majority of the students attending the two institutions must work part-time during the academic year, and therefore are limited on the number of course hours they can take. Student acceptance of this initiative has been very positive, and we expect that “year round” students will become the norm for our students. Exceptional students that enter SLCC or the UoU with prior credits from concurrent high school programs or Advanced Placement classes are able to move through Masters Degree Programs in the traditional time frame of BSCE degrees.

The challenges of preparing a community college student for success at the university (a level I Research institution) are examined. The roles of the community college and the University of Utah in facilitating the transition from the two year environment to a research university environment are examined. Successes and challenges are evaluated, and future areas of collaboration are described in this study. The positives and negatives for starting in the Civil Engineering program at the UoU versus starting at the Civil Engineering program at SLCC are compared and discussed.

Introduction

UoU Civil Engineering Department and the SLCC Civil Engineering Program are involved in a unique educational partnership which greatly benefits the people in the Salt Lake Valley. Presently SLCC Civil Engineering students, after completion of their first two-year program, have the opportunity to seamlessly transfer to the UoU Civil Engineering Department and most students are able to complete their four year, ABET, accredited BSCE degree from the UoU in

an additional four semesters. The SLCC Engineering Department offers an Associate Degree in civil engineering.

The greatest success is that students are able to plan out their academic careers with assurance that they are not going to waste any time and precious tuition dollars. By the time a student transfers to the UoU, they already know the Chair of the Civil & Environmental Engineering department and the other members of the faculty.

A recent advancement has been the partial integration of the American Society of Civil Engineering (ASCE) student chapter at SLCC and the ASCE student chapter at the UoU. The students from the two institutions cooperate on scientific projects and activities. Participation in the Concrete Canoe and Steel Bridge competitions provides an extra ordinary opportunity for underclass students to gain an appreciation of the design process, and to build a network with the UoU students.

SLCC offers courses that cover all of the subjects that are included in the General Section of the Fundamentals of Engineering Exam (F.E.). Some UoU students take advantage of a summer semester F.E. review course that is regularly offered at SLCC. Since a passing score on the F.E exam is required for graduation in Civil Engineering at the UoU, this intensive review opportunity has become essential for the success of many of our students. It should be recognized that over 50% of the UoU civil Engineering graduates have fulfilled L.D.S. Church missions that require a two year break in the middle of their programs of study.

This combined program between SLCC and the UoU has been developing over the past several years. The major problems that have been overcome are:

** UoU faculty members' confidence in the faculty at SLCC has steadily grown to the point that the expectation is for students transferring from SLCC to be on par with students that started at the UoU. The quality of the faculty at SLCC is very good. It has taken a great deal of support from the SLCC administration to bring this about.*

** Students at SLCC are being asked to perform to a high standard, and are expected to spend at least three to four hours outside of classes for every credit hour. The faculty at SLCC is setting an expectation of student effort that will prepare them for major level course work at the UoU, where students regularly spend three hours per credit hour in outside study time.*

** Faculty at the UoU has come to see the program at SLCC as a valuable part of a team effort where all members benefit from cooperation. The faculty at the UoU, while not ignoring lower division offering, have more time to focus on upper division and graduate course work.*

The relationship between the two programs has been successful because there is a sincere desire to serve the community, strong co-operation, good faculty ties, and aggressive institutional support. Mutual respect continues to enhance the partnership. The UoU Civil Engineering Department has over 300 undergraduate students and 80 graduate students. The Civil Engineering Program at SLCC educates approximately 25 students annually that transfer to the UoU Civil Engineering Department. During the last ten years the two programs have developed a completely articulated program allowing the Civil Engineering students from the community college to transfer seamlessly into the university civil engineering department. In addition, Civil Engineering students from UoU have the opportunity to take advantage of the

summer and evening courses being offered at SLCC. Currently, around 25% of UoU Civil Engineering graduates have taken at least one class at SLCC.

This paper will cover the following topics;

- *About Salt Lake Community College*
- *About University of Utah*
- *History*
- *Student Profile*
- *Preparation in Mathematics and English*
- *How do we keep the programs Coordinated?*
- *Success and Challenges*
- *Conclusions*

About 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 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.

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 departments, including those in this study, enjoy articulation agreements, with four-year colleges and universities within the State of Utah.

About University of Utah

The University of Utah is a leading public and teaching institution with diverse disciplines for both undergraduate and graduate students. In 2002 the U of U was ranked at number 37 in the top public research schools in the USA. 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.

History

SLCC was founded in 1948 as a technical/vocational school. Originally it was called Utah Technical College, and was located in downtown Salt Lake City. 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 the "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.

Student Profile

SLCC is the second largest public institution of higher education in Utah, and has the most diverse student body. (See Table 1) The data in Table 1 reflect credit bearing classes. 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.

Table 1

STUDENTBODY PROFILE

(Based on Fall Semester 2002, third week figures)

- 23,154 Students, Headcount
- 14,062 Students, FTE

- 47% Freshmen
- 33% Sophomores
- 2% Veterans
- 52% Male
- 48% Female
- 97% Utah Residents
- 3% Non-Residents
- 10% Students with Disabilities
- 1% American Indian/Alaskan Native
- 4% Asian/Pacific Islander
- 1% Black
- 6% Hispanic

AVERAGE STUDENT AGE

26 years old

STUDENT TO FACULTY RATIO

20 students to 1 faculty member.

NUMBER OF GRADUATES

2,776 students graduated during the 2001-2002 school year.

SLCC's Engineering program was initiated in 1985. In 1985 the Utah Board of Regents approved the Associate of Pre-major Engineering degree (APE). Most associate degrees offered by SLCC meet the general education requirements for a 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 often 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. Summer semesters provide the students an opportunity to complete these requirements as their schedule permits.

Currently SLCC offers 8 different engineering options for APE degree candidates (Table 2).

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	12
• Computer Science Engineering	66.5 minimum	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	5
• Mechanical Engineering	72 minimum	10
• 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. The civil engineering program at SLCC enjoys a complete match with that of the first two years of course work at UoU. Table 3 shows the course work and the number of credits for the Civil Engineering APE degree at SLCC.

**Table 3
Civil Engineering Plan of Study – Salt Lake Community College**

First Fall Semester			First Spring Semester		
Chemistry	CHEM 121	4	Chemistry	CHEM 122	4
Chemistry Lab	CHEM 123	1	Chemistry Lab II	CHEM 124	1
English I	ENGL 101	3	English II or Technical Writing	ENGL 201 Or ENGL 210	3
Calculus I	MATH 121	4	Calculus II	MATH 122	4
Engineering Physics - Mechanics	PHY 2210	4	Engineering Computing	CS 1050	3
General Education		3	Statics	CEEN 130	3
Total		19	Total		18
Second Fall Semester			Second Spring Semester		
Civil Engineering Design	CEEN 110	3	Drafting – AutoCAD	Arch 131	3
Strength of Materials	CEEN 231	2	Surveying	CEEN 203	3
Strength of Materials Lab	CEEN 233	1	Engineering Economics	CEEN 213	3
Dynamics	CEEN 234	2	Structural Thec	CEEN 241	3
Electrical Engineering or Material Science Engineering	EE 1060 or MSE 2170	1.5	Thermodynam	CHE 285	2
Differential Equations	MATH 225	3	Calculus III	MATH 221	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**

Preparation in Mathematics and English

Students at SLCC range from the 18 year old recent high school graduate, to returned LDS missionaries, 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 results of all SLCC students are accessible. 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. Students who start in developmental math programs successfully complete differential equations and Calculus III. 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 UoU requires an additional general education course in a diversity content area, which is completed during the junior or senior years

How do we keep the programs Coordinated?

In 1984 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 in sync with both Utah State and the University of Utah, SLCC hosts two Program Advisory Committee (PAC) meetings each year. The meetings are usually one in Fall semester and one in the Spring semester. Typically the engineering advisor from Utah State, and department representatives from the University of Utah attend. Specific perceived problems are discussed, and potential solutions are developed at the meeting, which also gives faculty the opportunity to discuss upcoming program changes and concerns. Selected representatives from local businesses and past SLCC graduates also attend.

Official meetings ensure that at least twice year faculties 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 at the two institutions. Faculties 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 or ASME. There are also departmental engineering days at UoU, and SLCC students are encouraged to participate. University faculties 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 faculty work hard to insure the content and quality of course work is consistent with that at the university. Course outlines, and in most cases, common text books are used. Term projects are similar in nature and scope. Mutual respect and communication between faculties is imperative to making this program work effectively.

Success and Challenges

The greatest success is that students are able to plan out their academic careers with assurance that they are not going to waste any time and precious tuition dollars. By the time a student transfers to the UoU, they already know the Chair of the Civil & Environmental Engineering department and the other members of the faculty.

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References

- [1] Salt Lake Community College 2003-2004 General Catalog
- [2] Fact Book Salt Lake Community College 2002-2003
- [3] University of Utah 2003-2004 General Catalog

DR. NICK M. SAFAI is Professor and the head of the Engineering Department (which consists of 9 engineering sub-departments: Bioengineering, Civil, Mechanical, Electrical, Chemical, Material Science, Environmental, Manufacturing and Computer Engineering). He received from **Princeton University** his Ph.D. in Engineering, MS in Aerospace and Mechanical Engineering, MSE in Civil Engineering, and an MSE in Reservoir Engineering/Water Resources (all from Princeton University), as well as a B.S. in Mechanical Engineering from **Michigan State Univ.** 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 taught both at the graduate and undergraduate levels in engineering science. He has performed research projects for the **Department of Energy (DOE)**, **Department of Defense (DOD)**, **National Science Foundation (NSF)** and the Oil Industry. He has authored over 65 technical publications in Technical Journals, Government & Industry project reports, DOE, DOD and (NSF). Nick's research areas of interest have been Solid Mechanics & Fluid Flow coupling, 3-D Multiphase Flow in an Unsaturated / Saturated Deforming Porous Medium, Wave Propagation & Stress Concentration, and Filamentary Composite Materials.

Dr. Safai is a member of several national and international Professional Engineering Organizations such as: American Society for Engineering Education (ASEE), American Society of Mechanical Engineers (ASME) and American Society of Civil Engineers (ASCE). He has served in various capacities in these societies. He has served for ASEE since 1991; as the Vice Chair for ASEE Annual Conference Programs, a session chair, and reviewer. Dr. Safai is responsible for bringing to SLCC engineering department professional societies (ASME in 1992, ASCE in 2001). Nick is the ASCE chapter president for SLCC. He has organized several other student national & international societies and activities.

Nick has over 25 years of full time teaching experience and has received four outstanding faculty awards. He also has extensive managerial/administrative experience both in Industry and at academic institutions. For the past 10 years as the Head of Engineering Department (which consists of 9 engineering sub-departments), he has had major managerial/administrative duties. Nick has had the major role in starting the Engineering department and in bringing the 9 different engineering programs to SLCC which are all articulated with the institutions/universities in the state of Utah. Nick has represented SLCC in a number of capacities including the Engineering Initiative of Governor Leavitt in State of Utah.