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ABSTRACT

Based on the premise that there has been relatively little effort in coordinating the activities of engineering-related areas in the community college to those of the engineering schools, a project to improve these efforts in the State of Missouri was undertaken and is discussed in this paper. The project has generated cooperative curricula between each of the public two-year community colleges in the State of Missouri and the University of Missouri. A new degree of cooperation between individuals at the various community colleges and the University of Missouri has been developed. (Author/EB)

ENGINEERING EDUCATION AND THE REAL WORLD

ATTRACTING STUDENTS TO ENGINEERING-THE ARTICULATION OF ENGINEERING STUDENTS, THE COMMUNITY COLLEGE, AND THE ENGINEERING SCHOOL

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Wichita State University

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SUMMARY

There has been relatively little effort in coordinating the activities of engineering related areas in the community colleges to those of the engineering schools. The National Science Foundation has funded, under NSF Grant No. 9714, a project to improve the cooperative effort of those institutions in the State of Missouri. The Project Director is Dr. Larry David from University of Missouri, Columbia, and the Co-Director is William F. Schallert from Florissant Valley Community College. This project has generated cooperative curricula between each of the public two-year community colleges in the State of Missouri and the University of Missouri. A new degree of cooperation between individuals at the various community colleges and University of Missouri has been developed.

INTRODUCTION

The community college has been the fastest growing segment in higher education. These colleges have provided an additional path for the student planning to study engineering. Figure 1 illustrates the parallel path of engineering education in the community college to that of the university lower division studies. The student thus has additional means of beginning his engineering education. The importance of the community college in engineering

education is indicated by a greater number of students following this alternative path.

This additional opportunity for engineering education, however, has created problems of its own and the student using this alternative must plan for transfer from the community college to the engineering school. The student is faced with the problem of integrating course work listed in the community college catalog with that of his intended senior institution. In the past, the transfer student has had to wait until he completed his community college studies to obtain an evaluation of his course work by the engineering school. With this approach the student has his community college course approved at the time he enters his freshman year at the community college. In essence, he has started his engineering education for the intended transfer institution while physically located at the community college.

NSF PROJECT

The primary purpose of the NSF Project is the enhancement of engineering education through improved articulation with the junior colleges as well as the improved communications with the senior institutions. This has been accomplished by means of a coordinative program of self-evaluation, planning based on this evaluation, and actual implementation of these plans. Within this broad objective several sub-objectives have been identified. The first is improved communications between the faculty of the junior colleges and the faculty of associated

senior institutions. The second sub-objective is the development of model transfer programs of study for each of the cooperating schools in order to aid in career advisement so that students may transfer with maximum ease to the various engineering programs at the senior institutions.

The population for the cooperative effort is identified in Figure 2. The initial emphasis has been directed towards satisfying the project objectives relative to the community colleges and UMC.

Figures 3 through 6 illustrate a sample of the resulting effort to satisfy these objectives between UMC and FVCC. Figure 7 hows one of the programs generated between FVCC and UMR.

SAMPLE PROGRAM

Figures 3 through 6 have been reproduced from the brochure published for FVCC. The brochure has been used at FVCC for student counseling and advising. It has also been used by the twenty-nine high schools surrounding the FVCC campus. Prior to this publication, many students had been taking two years at FVCC and transfering to UMC with few problems. Since this brochure has been in use, not only has the transfer process been perfected, but the high schools have accepted, to a greater degree, the community college as an adequate institution for the prospective engineering student.

By identifying representatives of the various disciplines at each institution the student is now able to obtain more detailed information than was previously possible. There has also been increased communications between the two institutions through contacts generated by corresponding representatives.

COORDINATED EFFORT

The past two summers have been used to bring together representatives from the various community colleges with the University of Missouri. The first summer was used to develop coordinated articulation programs. A brochure for each community college has been generated through this activity. The second summer was used to improve instruction in Computer Programming and Engineering Mechanics through intensive course work at UMC.

A coordinated effort between FVCC and UMR has resulted in a similar brochure. Figure 7 shows the format used to integrate the two programs in the Civil Engineering area.

This effort will continue through the third funded year of the NSF Project. The project includes plans for continuing cooperation and updating published materials. Through this process of cooperative effort, the status of engineering education in Missouri will be enhanced. Results to date are sufficiently encouraging to recommend the approach to other states.

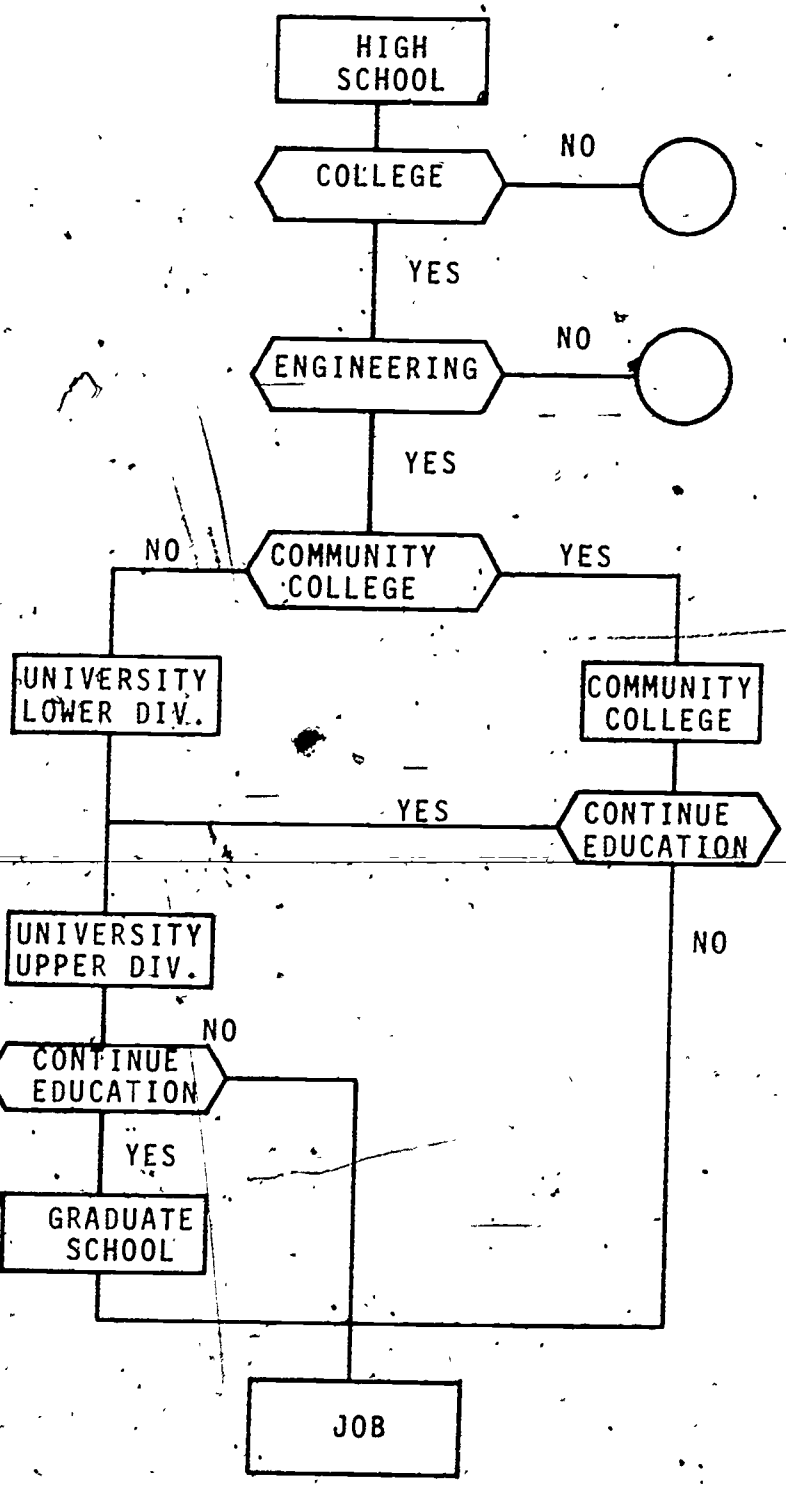
HIGH SCHOOL
COLLEGE
NO
YES
ENGINEERING
NO
YES
NO
COMMUNITY COLLEGE
YES
UNIVERSITY LOWER DIV.
COMMUNITY COLLEGE
YES
CONTINUE EDUCATION
NO
UNIVERSITY UPPER DIV.
NO
CONTINUE EDUCATION
YES
GRADUATE SCHOOL
JOB

Figure 1

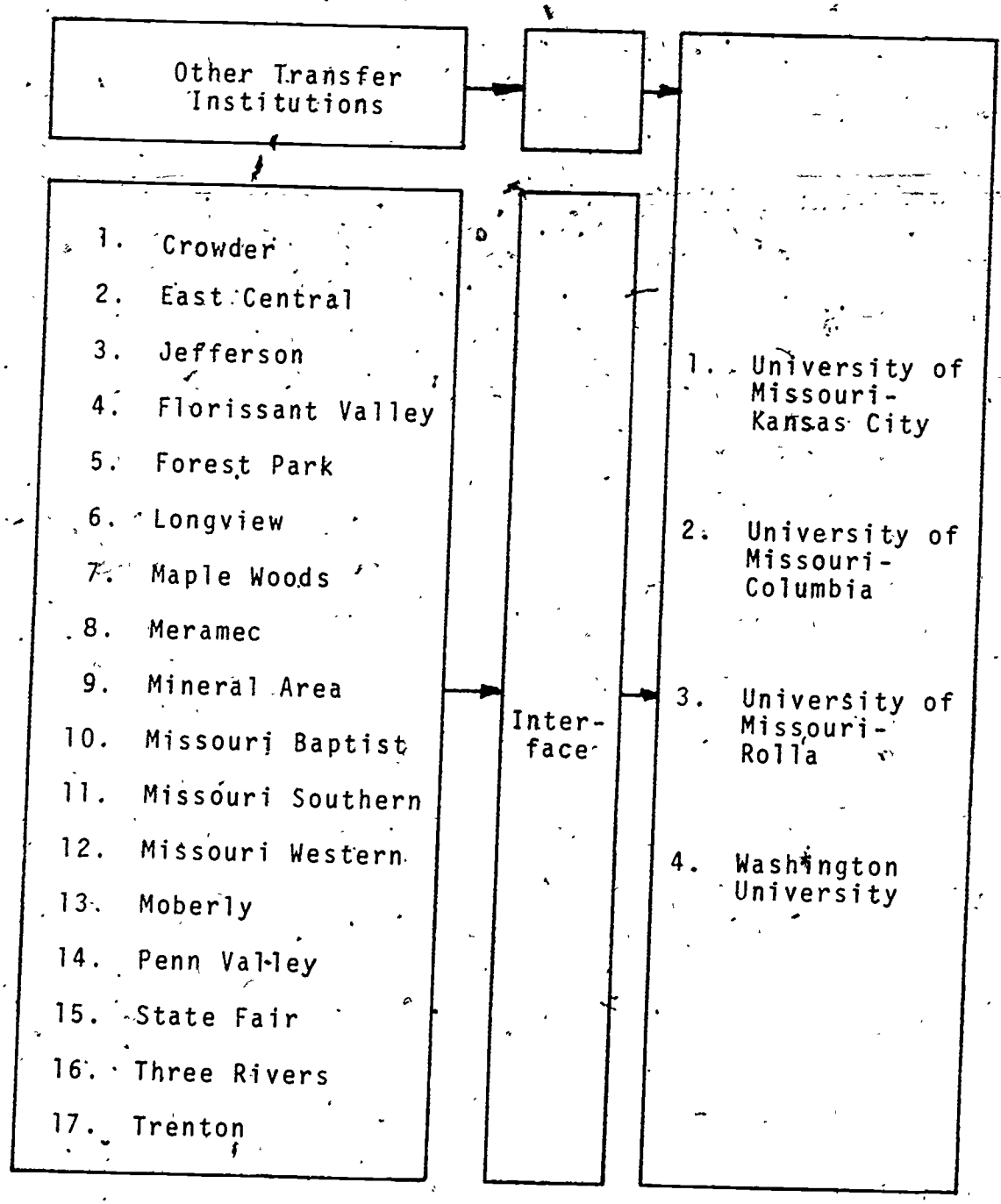

Figure 2
Population

This brochure demonstrates a cooperative program between the College of Engineering, University of Missouri-Columbia, and the Engineering Division of Florissant Valley Community College. This cooperative arrangement has been made possible by a grant* from the National Science Foundation. The pre-engineering program illustrated in this brochure will minimize transition problems for the student transferring to the University of Missouri-Columbia.

Additional information concerning the Engineering Transfer Program at Florissant Valley Community College can be obtained by contacting the following at:

Florissant Valley Community College
3400 Perahall Road
St. Louis, Missouri 63135
Phone: 314 524-2020

Agricultural Engineering
Chemical Engineering
Industrial Engineering

William F. Schallert, P.E.
Chairman, Engineering Division

Civil Engineering

Kenneth Smith, P.E.

Electrical Engineering

Vincent Cavanaugh, P.E.

Mechanical Engineering

Andrew Lindberg, P.E.

Information concerning admission policies and requirements can be obtained from:

Gordon Benson
Associate Dean of Admissions

*Cooperative Program for Junior Colleges
NSF Grant #9714

For additional information concerning departmental programs, contact the following at the University of Missouri-Columbia.

Agricultural Engineering
Professor Harold Walton
108 Agricultural Engineering Bldg.
Phone: 314 882-6328

Chemical Engineering
Professor Richard Angus
0078 Engineering Building
Phone: 314 882-3769

Civil Engineering
Professor Jay McGarraugh
0066 Engineering Building
Phone: 314 882-4688

Electrical Engineering
Professor Rex Waid
232 Electrical Engineering Bldg.
Phone: 314 882-6266

Industrial Engineering
Professor Larry David
102 Electrical Engineering Bldg.
Phone: 314 882-2691

Mechanical Engineering
Professor David Wollersheim
1022A Engineering Building
Phone: 314 882-6560

Nuclear Engineering
Professor Walter Meyer
1026A Engineering Building
Phone: 314 882-3550

Undecided Majors
Professor Larry David
102 Electrical Engineering Bldg.
Phone: 314 882-2691

Figure 3

FLORISSANT VALLEY COMMUNITY COLLEGE

Florissant Valley Community College is one of the colleges in the Junior College District of St. Louis-St. Louis County. The present grounds at 3400 Pershall Road in Ferguson were acquired early in 1963, and temporary facilities were opened in August. A permanent building program began in 1966 and was completed in 1970. In 1963 the campus was a 108-acre wooded and rolling farm plot. Today that site is one of the most outstanding contemporary college campuses in the midwest. Buildings include: Theatre, Humanities, Communications, Social Science, Student Center Instructional Resources, Gymnasium, Science, Business, Engineering, and Administration.

Florissant Valley Community College is open to any district resident who is a high school graduate or equivalent. Day and evening programs are offered during the regular semesters and summer sessions. Classes are small and outstanding laboratory facilities are available for ideal learning situations. Scholarships and financial aids are available and there is a full range of student activities including intramural and sports events. The College is fully accredited by the North Central Association of Colleges and Secondary Schools. Students may choose college parallel courses to match the engineering freshman and sophomore requirements at the University of Missouri-Columbia.

ENGINEERING PROGRAMS
UNIVERSITY OF MISSOURI-COLUMBIA

After completion of the first two years at Florissant Valley Community College, a student can complete the requirements for the Bachelor of Science degree with two additional years at the University of Missouri-Columbia. Any student is eligible for admission as long as his scholastic record has been satisfactory. Application for admission may be obtained by writing to the Director of Admissions.

Each transfer student will be assigned a permanent adviser in the department of his choice. In consultation with his adviser, the student should plan a total program to take advantage of the hours of electives listed in the junior and senior year. A wide variety of possibilities are available depending upon a student's particular interest and career objectives. Elective possibilities could include bioengineering, prelaw studies, premedical studies, computer engineering, environmental engineering, ecology, health care systems design, energy engineering, biological sciences, nuclear engineering, agriculture, and management. Elective sequences can also be selected within the student's own department.

All Departmental programs listed are fully accredited by the Engineers Council for Professional Development.

Figure 4

ENGINEERING TRANSFER PROGRAM
FLORISSANT VALLEY COMMUNITY COLLEGE

The two-year program listed below is common for all engineering fields except for the deviations noted for Chemical Engineering. The curriculum satisfies the general education requirements for an Associate in Arts degree. In this program, a student may take his first two years at Florissant Valley and transfer to the University of Missouri-Columbia for his junior and senior years. The junior and senior year programs are listed separately for each departmental major.

first semester	sem. hours
40.101 English Composition I	3
72.113 General Chemistry I	4
50.125 Analytic Geometry and Calc I	5
30.107 Scientific Computer Prog.	2
90.XXX Physical Education	1
Humanities-Communications elective	3
total	18

second semester	sem. hours
40.102 English Composition II	3
50.126 Analytic Geometry and Calc II	5
78.106 Engineering Physics I	4
*30.100 Engineering Drawing or 30.105 Engineering Graphics	3
90.XXX Physical Education	1
total	16

* Chemical Engineering students should substitute 72.114 General Chemistry II for 30.100 Engineering Drawing or 30.105 Engineering Graphics.

third semester	sem. hours
50.225 Analytic Geometry and Calc III	5
78.203 Engineering Physics II	4
30.211 Engineering Mechanics I	3
*30.215 Electric Circuits I	4
total	16

fourth semester	sem. hours
50.226 Differential Equations	3
Social Science elective	3
82.100 American Civilization	3
80.101 Principles of Economics I	3
*78.204 Engineering Physics III	4
total	16

The following engineering electives can be taken for transfer credit toward an Engineering degree at the University of Missouri-Columbia.

	sem. hours
30.212 Engineering Mechanics II for MAE/CE 185 Introduction to Dynamics	3
30.216 Electric Circuits II for EE 205 Circuit Theory	4

* Chemical Engineering students should substitute 72.211 Organic Chemistry I, and 72.212 Organic Chemistry II.

Figure 5

MECHANICAL/AEROSPACE ENGINEERING

Mechanical engineering covers the design, analysis, and control of machine systems, the understanding and use of materials, and the generation and utilization of mechanical power. Mechanical engineering is dependent upon a firm base in mathematics, the humanities, and the physical sciences, with increasing interest developing in the biological sciences.

Due to the interrelationships between the various engineering disciplines, excellent opportunities exist for cooperation with electrical engineering in control systems and energy processes, civil engineering in applied mechanics, nuclear engineering in power systems and material properties, chemical engineering in energy and transport phenomena, industrial engineering in manufacturing methods, and agricultural engineering in machine systems.

Aerospace engineering represents an extension of mechanical engineering into the "off-the-ground" environment. Those involved in this important area are concerned with material properties, lightweight structural considerations, control systems analysis, heat transfer propulsion systems, aerodynamics, and many other activities related to space and aircraft.

Mechanical engineering and aerospace engineering are based largely upon the same fundamental principles of science and technology; consequently, the curricula are identical for the first two years. They diverge somewhat during the junior year, and offer possibilities for uniquely different programs during the highly-elective senior year.

MECHANICAL ENGINEERING

JUNIOR AND SENIOR YEAR PROGRAM

fifth semester	sem. hours
Engr 99 Engr. Thermodynamics I	3
MAE 185 Introduction to Dynamics	3
Engr 195 Intermediate Strength of Materials	3
EE 205 Circuit Theory	
or	
Engr 126 Computer and Information Systems	3
Humanities-Social Science	3
total	15

sixth semester	sem. hours
MAE 199 Engr. Thermodynamics II	3
MAE 224 Science of Engr. Materials	3
MAE 252 Instrumentation and Measurements Lab I	2
MAE 251 Fluid Mechanics	3
Humanities-Social Science	3
Elective	3
total	17

seventh semester	sem. hours
MAE 262 Instrumentation and Measurements Lab II	2
MAE 256 Design of Machine Elements	3
MAE 285 System Dynamics	3
English 161 Technical Writing	
or	
Speech 75 Introduction to Speech Communication	3
Electives	6
total	17

eighth semester	sem. hours
MAE 296 Design Synthesis	3
MAE 299 Heat Transfer	3
Electives	10
total	16

Figure 6

Florissant Valley Community College
University of Missouri - Rolla

Civil Engineering

First Year FVCC

40.101	English Comp I	3	30.100	Engineering Drawing	3
50.125	Anal Geom & Calc I	5	50.126	Anal Geom & Calc II	5
72.113	General Chemistry	4	78.106	Engr Physics I	4
82.100	American Civ	3	90.102	Physical Education	1
90.101	Physical Education	1	95.201	General Psychology	3
		16			16

Second Year FVCC

30.211	Engineering Mech	3	30.107	Sci Computer Prog	2
50.225	Anal Geom Calc III	5	30.212	Engr Mech anics II	3
78.203	Engr Physics II	4	14.095	Plane Surveying	3
80.101	Prin of Economic I	3	50.226	Diff Equations	3
			Elect	Hum/Soc Sci	6
		15			17

Third Year UMR

ME227	Thermal Anal	3	CE261	Microbiology	2
CE102	Advanced Surveying	2	CE218	Struct Anal	5
EM110	Mech of Mtls	3	CE215	Elem Soil Mech	3
EM120	Mtls Testing Lab	1	CE216	Const Mtls	3
CE230	Elem Fluid Mech	3	EE281	Elec Circuits	3
GeE50	Geology for Engr	3	CE243	Engr Law & Contracts	2
CE232	Elem Fluid Mech Lab	1			
		16			18

Fourth Year UMR

CE201	Prof Seminar	0	CE221	Str Design in Metals	3
CE223	Reinf Con Design	3	Elect	Hum/Soc Sci	3
CE211	Transpor Engr	3	Elect	Civil Engineering	6
CE229	Foundation Engr I	2	Elect	Free	5
CE265	Water & Waste Water Engr.	4			
CE241	Engr Economics	3			
		17			17

Figure 7