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UTAH SYSTEM OF
HIGHER EDUCATION

Building a Stronger State of Minds

AGENDA

MEETING OF THE
UTAH STATE BOARD OF REGENTS
TO BE HELD AT
THE COLLEGE OF EASTERN UTAH, PRICE, UTAH
JENNIFER LEAVITT STUDENT CENTER

SEPTEMBER 5, 2008

Utah State Board of Regents
Office of the Commissioner of Higher Education
Board of Regents Building, The Gateway
60 South 400 West
Salt Lake City, Utah 84101-1284

August 27, 2008

MEMORANDUM

TO: State Board of Regents

FROM: William A. Sederburg

SUBJECT: Utah State University–Doctorate of Philosophy in Engineering Education–Action Item.

Issue

Officials at Utah State University (USU) request approval to offer a Doctorate of Philosophy in Engineering Education, effective Spring Semester 2009. The USU Institutional Board of Trustees approved this program on 23 May 2008. The Regents' Program Review Committee approved the proposed degree on August 5, 2008.

Background

The proposed degree is the culmination of a multiyear initiative to refocus the department and develop a new emphasis in engineering education. This new focus is supported by a ten million dollar grant from the National Science Foundation to establish the National Center for Engineering and Technology Education at Utah State. While Engineering and Technology Education (ETE) will continue to support a Ph.D. in technology education through the College of Education and Human Services, the new emphasis in engineering education within the department is sufficiently different from the technology education program that a new doctoral degree, with a very different set of requirements, is warranted.

While engineering education has some similarities to existing science, technology, and mathematics education specializations, it has one critical difference. Engineering education emphasizes the learning and teaching of engineering design, a decision-making process which utilizes results from basic sciences, mathematics, and the engineering sciences. The goal of this program is to produce doctoral students with proficiency in developing engineering design skills in others and expertise in research into how those skills are best learned and taught. The Engineering Education doctorate will produce graduates who are familiar with the theory and practice of engineering education, are able to guide and perform research within a specific area of engineering education, and have the ability to design,

implement, and assess both high school and college level engineering curricula. These individuals are expected to enter a variety of professions including engineering education faculty, engineering faculty, and engineering technology faculty.

Policy Issues

Other Utah System of Higher Education institutions have reviewed this proposal, have given input, and are supportive of Utah State University offering this degree.

Commissioner's Recommendation

The Commissioner recommends that the Regents approve the Request to Offer a Doctorate of Philosophy in Engineering Education at Utah State University, effective Spring Semester, 2009.

William A. Sederburg, Commissioner

WAS/GW/HN
Attachment

Academic, Career and Technical Education and Student Success Committee

Action Item

Request to Offer a Doctorate of Philosophy

in Engineering Education

Utah State University

Prepared for
William A. Sederburg
By
Gary Wixom

August 27, 2008

Section I

The Request

Utah State University requests approval to offer a doctorate of philosophy in engineering education effective Fall 2008. This program has been approved by the Institutional Board of Trustees on 23 May 2008.

Section II: Program Description

The Engineering and Technology Education Department proposes to offer a Doctorate of Philosophy in Engineering Education. While engineering education has some similarities to existing science, technology, and mathematics education specializations, it has one critical difference. Engineering education emphasizes the learning and teaching of engineering design, a decision making process which utilizes results from basic sciences, mathematics, and the engineering sciences. The goal of this program is to produce doctoral students with proficiency in developing engineering design skills in others and expertise in research into how those skills are best learned and taught. This program will produce graduates who:

1. Are familiar with the theory and practice of engineering education and are adept at these aspects within their specific area of engineering specialization
2. Have the ability to conduct research in engineering education in areas such as engineering epistemologies, engineering learning mechanisms, engineering learning systems, engineering diversity and inclusiveness, and engineering assessment.
3. Have the ability to develop/implement/assess engineering curricula at both the high school and university levels.

To achieve these goals, students will complete a minimum of sixty credit hours, combining course work and research. The curriculum has been divided into three components, an engineering education core, an area of specialization, and a research component.

The Engineering Education Core. This curricular component recognizes that engineering education is an emerging discipline. As such, students are unlikely to enter the program with strengths in *both* engineering and education. The core curriculum will be used to fortify the engineers' skills in program design and assessment and to fortify the educators' skills in analysis and design.

The Area of Specialization. This curricular component will allow the students to develop an in-depth knowledge in one area of engineering education. Students will identify a theme for their research and take courses within that area. The theme and courses will be identified and chosen with the advice and approval of the student's doctoral advisory committee. Three credits of these courses must be taken outside the Engineering and Technology Education Department.

The Research Core. The research core ensures that program graduates have the skills necessary for, and experience in, performing engineering education research. This curricular component has two sections. The first is a series of courses in research methods. Education research methodologies fall into two broad categories, quantitative and qualitative. Students will take one course focused on each of these techniques,

followed by an advanced course in the methodology being used in their dissertation. In the second section students develop a research project that culminates in a dissertation.

The Department of Engineering and Technology Education (ETE is administratively housed in the College of Engineering). The department has offered graduate degrees at the master's degree level for many years. In addition, Ph.D. degrees in technology education have been offered to students through the College of Education and Human Services in Curriculum and Instruction specialization. Currently, there are seven full time technology education doctoral students supported on research and teaching assistantships. Three students will receive their Ph.D. degrees in 2008. Graduates have been employed primarily in universities where they are involved in technology teacher education and supporting research.

This proposal requests authorization to offer the Ph.D. degree through the Department of Engineering and Technology Education in the College of Engineering. This degree request is the culmination of a multiyear initiative to refocus the department and develop a new emphasis in engineering education. This new focus was supported by a ten million dollar grant from the National Science Foundation to establish the National Center for Engineering and Technology Education at Utah State. While ETE will continue to support a Ph.D. in technology education through the College of Education and Human Services, the new emphasis in engineering education within the department is sufficiently different from the technology education program that a new doctoral degree with a very different set of requirements is warranted. Approval to offer the Engineering Education Ph.D. through the ETE department will be a major step in meeting the department's established long-range goals.

Purpose of the Degree

The Engineering Education doctorate will produce graduates who are familiar with the theory and practice of engineering education, are able to guide and perform research within a specific area of engineering education, and have the ability to design, implement, and assess both high school and college level engineering curricula. These individuals are expected to enter a variety of professions including engineering education faculty, engineering faculty, and engineering technology faculty.

Institutional Readiness

Utah State University is ready to implement this degree program with no significant additional resource requirements.

New Organizational Structures

Engineering Education will be a program of the College of Engineering. The Engineering Education Program will be lead by the Head of Engineering and Technology Education, reporting to the Dean of the College of Engineering.

Impact on Learning Resources and Instructional Technology

The department has been working with university resources, such as the library, since the change process began. For example, the journal subscriptions required for the new emphasis have already replaced those that are no longer needed. No additional impact on the learning resources, such as the library, or on instructional technology facilities, is expected. (see Appendix D – Letter from Library)

Impact on the Budget

No impact on the university budget is expected. The new degree program results from changes within the department; no new financial resources will be required.

Impact on Faculty

No additional faculty will be required for the implementation of this program. This program will primarily use courses already taught by faculty in a number of different departments but primarily within the Engineering and Technology Education Department. Required courses taught by the College of Education will be done so in agreement with the College of Engineering and College of Education and Human Services. (see Appendix E – Letter of Agreement between College of Engineering and College of Education and Human Services). All of the new courses required for this new program have been created as part of the National Center for Engineering and Technology Education and are, therefore, already in existence. Some existing Engineering and Technology Education Department courses will be revised. However, these revisions will occur as part of the normal course updating process. (See Appendix B: Program Curriculum)

Impact on Staff

This program will use existing staff within the Engineering and Technology Education Department. No additional staff is required.

Faculty

This degree proposal represents the completion of a departmental change in emphasis that began with the name change three years ago. As such, the change is evolutionary rather than revolutionary. Because of the changes within the department, no additional faculty will be required. Using State appropriated funding (Engineering Initiative Funds), the Department will be hiring two new faculty over the next two years. Faculty will teach undergraduate engineering courses for the College of Engineering, and each faculty member will participate in the PhD program. The Engineering and Technology Education Department had a retirement of one professor this past year, and his replacement will be directed toward support of the new degree program by hiring an individual with a background in cognition and a specialization in engineering and technology education. The Program will not depend on the use of adjunct faculty. Adjunct faculty may be utilized to provide special opportunities to students, but tenure track faculty with doctorates will be the norm. For existing faculty, see Appendix C.

Staff

No additional staff members are required. The current resources from within the Department of Engineering and Technology Education will be able to accommodate the new program. Additional office support for the new faculty will be augmented from externally funded research projects.

Library and Information Resources

The new degree program is an evolutionary change of the department. The changes to the library and information resources needed to support excellence in the program have already been made. (see Appendix D – Letter from Library)

Admission Requirements

Students accepted into the program will be required to meet the current standards for admission to the Graduate School including:

- a master's degree in engineering that will be completed before matriculation in the degree program,
- a 3.0 or higher grade point average (or equivalent) on the last 60 semester or 90 quarter credits,
- a score at or above the 40th percentile on Graduate Record Examination, and
- satisfactory letters of recommendation.

In addition, the program will require the submission of a short, typed essay (2 to 3 pages, double-spaced) in which the student identifies his or her particular academic interests and the submission of a current curriculum vita.

Student Advisement

The Graduate Coordinator of the Engineering and Technology Education Department will act as each student's advisor until the student chooses a research advisor and committee. Once the advisor and committee are chosen, they will take over student advising.

Justification for Number of Credits

This program will require the completion of 60 credits beyond the completion of a master's degree. The number of credits is consistent with the requirements of the Graduate School.

External Review and Accreditation

There are no accreditations available for engineering education at the doctoral level. To ensure excellence, the department will assemble an external advisory committee to review the program (as described in Section IV: Program and Student Assessment). This review process is similar to what is being used in the engineering education program at Purdue University.

Projected Enrollment

Projected FTE Engineering Education majors relative to FTE Engineering and Technology Education dedicated faculty is shown in the chart below. This ratio does not include other faculty providing courses used by Engineering Education majors because they will not be paid from Engineering and Technology Education funds.

Year	FTE Students (Doctoral)†	ETE Faculty (Current)	Approximate: Student: Faculty Ratio
2008-9	3	7	1 : 2.33
2009-10	6	9	0.66 : 1
2010-11	9	9	1 : 1
2011-12	12	9	1.33 : 1
2012-13	15	9	1.66 : 1

† Only students within the new program are included in these numbers. Currently, there are 7 doctoral students enrolled in the Interdepartmental Doctoral Program in the College of Education and Human Services.

No negative impact is expected on the enrollments of other programs. The Engineering and Technology Education Department currently offers a Doctorate through the Interdepartmental Doctoral Program in the College of Education and Human Services. Continued participation in that program is expected.

Section III: Need

Program Need

The Engineering and Technology Education Department is building on the existing strengths in technology education research and K-12 education by the addition of engineering education research and engineering education.

Engineering, as a profession, differs from many science and mathematics disciplines in its emphasis on creation and design rather than inquiry. Rapid changes in the worldwide engineering enterprise have motivated the profession to rethink how future generations of engineers should be educated to build analysis-based design skills. The recent NSF sponsored *Engineering Education Research Colloquies* identified five research areas of importance to the future of engineering. The research areas include engineering epistemologies, engineering learning mechanisms, engineering learning systems, engineering diversity and inclusiveness, and engineering assessment. Success in these areas will require the creation of individuals with expertise in engineering education.

Utah State University is home to one of only three departments in the nation in engineering education, with the other two programs at Purdue University and at Virginia Polytechnic Institute and State University. All three of these departments have been formed within the past three years.

The engineering education program is modeled after those at Purdue and Virginia Tech. The doctoral requirements chart shown in figure 1 indicates the coursework comparison of the three programs. Shown are the requirements for the program in the areas of research, engineering, and education.

Figure 1

Doctoral Program Requirements for Utah State University, Purdue University, and Virginia Tech.

	Utah State University	Purdue	Virginia Tech
Engineering (Elective - Area of Specialization)	ETE 7400-Occupational Analysis in Engineering and Technology Education ETE 7020-Design Thinking in ETE ETE 7030-Engr. Design & Analy. for ETE ETE 7040-Dynamic & Netwk. Engr. Processes for ETE	Students are required to complete 15 credit hours of graduate level engineering technical coursework.	5024-Design in Engr. Education and Practice 5204-Design of Laboratory Courses for Engr. & Science Educ. 5044-Using Virtual Reality & Visualization Tools in Engr. & Science Educ. 5044-Object-oriented Concepts for Engineering Education 5104-Preparing for the Engineering Professorate

	(9 Credits Required)	(15 Credits Required)	(9 Credits Required)
Engineering Education (Core)	ETE 7810-Research Seminar EDUC 7300-Foundations of Education ETE 7010-Role of Cognition in ETE ETE 6150-Evaluation and Assessment ETE 7230-Foundations of Engr. & Technology Education ETE 6450-Administration and Organization EDUC 7310-Teaching & Learning Foundations ETE 7460-Finance & Grant Writing (18 Credits Required)	ENE 500 or 600 Level Engineering Education Courses Seminar in Engineering Education	5404-Assessment Techniques in Engineering Education 5504-Practicum in the Engineering Classroom 5004-History, Theory and Practice of Engineering 5034-Contemporary Issues in Engineering Education 5014-Foundations of Engineering Education
Research	EDUC 6600-Research Design & Analysis I EDUC 7610-Research Design & Analysis II EDUC 6770-Qualitative Methods I EDUC 7780-Qualitative Methods II EDUC/SPED 7700-Single Subject Meth & Design EDUC 7650-Logitudinal Research Design & Analysis PSY 7070 Adv. Measurement Theory & Practice (9 Credits Required)	(15 Credits Required) Introductory Statistics (e.g. STAT 511) Introduction to Research (e.g. EDPS 533, TECH 646B) Introductory Research Methods Elective (qualitative or quantitative) Advanced Research Methods Elective (qualitative or quantitative)	(12 Credits Required) 5604-Quantitative Research Methods in Engineering Education 5614-Qualitative Research Methods in Education 6604-Advanced Engineering Research Methods 5314-Documenting Engineering Research 5324-Presenting Engineering Research 6624-Contemporary Issues in Engineering Education Research (9 Credits Required)
Dissertation Credits	PhD Dissertation Research (students must take an appropriate # of research credit hours to complement their grad program & be consistent with the Graduate School requirements) (minimum 24 credits)	PhD Dissertation Research (students must take an appropriate # of research credit hours to complement their grad program & be consistent with the Graduate School requirements) (24 credits)	PhD Dissertation Research (students must take an appropriate # of research credit hours to complement their grad program & be consistent with the Graduate School requirements) (30 credits)

Labor Market Demand

Depending on their individual skills and preferences, it is anticipated that graduates of this program would enter one the following careers.

Engineering Faculty or Engineering Technology Faculty– There is significant demand for engineering faculty with strength in curriculum development and management in the regional branches of universities, community colleges, and other universities whose primary mission is teaching.

Engineering Education Faculty– Engineering education is an emerging discipline. Nationally, we anticipate the addition of 2-4 new programs in the next five years, in addition to the 3 existing programs.

Industry Trainer – With corporate needs to educate their employees on a variety of engineering-based subjects (e.g. safety and engineering education), it is anticipated that a number of graduates would enter industry to develop and manage these programs.

Currently there is a national shortage of doctoral level engineering/engineering technology faculty. This shortage is due to high retirement rates in existing programs.

Student Demand

In the past three years, the ETE department has had a substantial increase in the number of inquiries for admission. In that time the number of in-house doctoral students has increased from two to five with a 3:1 application to admission ratio. Based on the applications for the coming year, the department anticipates this growth to continue. In addition, the department has been developing new recruiting materials to support this growth rate.

Two factors have driven this growth. The first is the emergence of engineering education as its own discipline at the university. The National Center for Engineering and Technology Education, located in the Engineering and Technology Education Department, is the most obvious example of this creation. The second is the significant interest in engineering education in K-12 at the state as well as national level. The National Academy of Engineering has convened a special committee to report on the status of P-12 engineering education. Their report should be available in 2008. The ETE department is assisting with the development of the Utah Pre-Engineering Pathway for the Utah State Office of Education.

Collaboration with and Impact on Other USHE Institutions

No USHE institution offers a doctoral degree in Engineering Education. There are no similar programs in Utah or the Intermountain West region.

Benefits to USU and USHE

This program will be the first in the State of Utah (and the third in the nation) that explicitly addresses the unique needs of engineering education. The program will generate graduates familiar with the theory and practice of engineering education, are adept at these aspects within their specific area of engineering specialization, have the ability to design, perform, analyze, and report state-of-the-art research in engineering education, and have the ability to design, implement, and assess engineering curricula according to national standards.

Consistency with Institutional Mission

The engineering education doctorate is consistent with the institution's mission to discover, create, and transmit knowledge through education programs at the graduate level, through research and development, and through service programs.

Section IV: Program and Student Assessment

Program Assessment

Every five years, the department will assemble an external advisory committee. The committee will examine the program's objectives and outcomes to determine if they continue to meet the needs of the program's stakeholders and to recommend necessary changes. Currently, the program's stakeholders

include the State of Utah, Utah State University, the Utah State Office of Education and its schools, the engineering education community, and our graduates. As currently specified, the five member committee will include members of the engineering education community, the technology education community, the College of Education and Human Services, and local industry. The first meeting of this committee is scheduled for 2012, allowing the graduation of two to three graduate student cadres and data gathering from the graduates.

In addition, the Engineering Education Doctoral Program will be internally assessed using a continuous quality improvement process. Each year the graduate faculty will meet to compare its stated objectives and outcomes with those achieved by the program. Weaknesses will be identified and corrective actions recommended. The following year, the results of the corrective actions will be examined and further changes recommended, if necessary.

Expected Standards of Performance

The students' performance of these outcomes will be determined using a combination of formative and summative assessments. The assessment points will include:

- Engineering Education and Specialization Cores
 - Classroom Performance (formative & summative) – Students are required to maintain a 3.0 overall average in all course, with no less than a C- grade in any single course.
 - Comprehensive Examination (summative) – Students are required to pass a comprehensive written examination based on their degree course work. This examination will be taken after completion of the required degree course work.
- Research Core
 - Research Proposal (formative) – Students are required to write and successfully defend the proposal for their dissertation research.
 - Dissertation (summative) – Students are required to perform research, write a dissertation, and defend the research and dissertation before their research advisor and committee.

Section V: Finances

Funding Sources

This program is already funded. Any additional funds required for implementation of the program will be reallocated from the current College of Engineering and Department of Engineering and Technology Education Department Budgets.

Financial Analysis Form for All R401 Documents

	2008-09	2009-10	2010-11	2011-12	2012-13
Students					
Projected FTE Enrollment	3	6	10	11	12
Cost per FTE	20,557	18,439	17,528	17,430	17,350
Student/Faculty Ratio	.43:1	.67:1	1:1	1:1	1:1
Projected Headcount	3	6	10	11	12

Projected Tuition

Gross Tuition	19,740	50,391	73,757	109,006	136,459
Tuition to Program					

5 Year Budget Projection

	Year 1	Year 2	Year 3	Year 4	Year 5
Expense					
Salaries & Wages	51,000	96,240	156,490	171,750	187,020
Benefits	5,670	9,391	13,790	14,984	16,183
Total Personnel	56,670	105,631	170,280	186,734	203,203
Current Expense	5,000	5,000	5,000	5,000	5,000
Travel					
Capital					
Library Expense					
Total Expense	61,670	110,631	175,280	191,734	208,203

Revenue

Legislative Appropriation					
Grants & Contracts	52,500	105,000	174,880	191,294	207,723
Donations					
Reallocation	9,050	5,391			
Tuition to Program					
Fees	120	240	400	440	480
Total Revenue	61,670	110,631	175,280	191,734	208,203

Difference

Revenue - Expenses	0	0	0	0	0
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APPENDIX A: PROGRAM SCHEDULE
Engineering Education Core Courses (18 credits)

These courses are aimed at strengthening the student's background in engineering education. Students will choose courses to strengthen their existing background.

Engineering Education Core

ETE 7010	Role of Cognition in Engineering and Technology Education	3 credits
ETE 6090	Program Design	3 credits
ETE 6150	Evaluation and Assessment	3 credits
ETE 6450	Administration and Organization	3 credits
ETE 7230	Foundations of Engineering & Technology Education (revised course)	3 credits
EDUC 7300	Historical, Social, and Cultural Foundations of Education	3 credits
EDUC 7310	Teaching & Learning Foundations	3 credits
ETE 7460	Finance and Grant Writing	3 credits
ETE 7810	Research Seminar	1-3 credits

Area of Specialization (9 credits)

Graduates will have an in-depth knowledge of specialization within Engineering Education. This area is to be specified by the student in writing (with approval of their advisor and graduate committee) within the first year of their program of studies. This expertise will be obtained through the use of approved elective courses and regular interaction between the student, their major professor, and their graduate committee. This expertise must be demonstrated in the required written and oral examinations.

To encourage breadth of viewpoint in the students, doctoral students are required to take at least one elective in their area of specialization from another department (e.g. Education, Social Sciences, or Engineering)

Area of Specialization –Specialization Electives **9**
credits

Research Core (9 + 24 = 33 credits)

The research core ensures that program graduates have the skills necessary for and experience in performing engineering education research. This curricular component has two sections. The first is a series of courses in research methods. Education research methodologies fall into two broad categories, quantitative and qualitative. Students will take one course in each of these techniques, followed by an advanced course in the methodology being used in their dissertation. In the second section students perform a research project culminating in a dissertation.

Research Theory Core (9 credits)

EDUC 6600	Research Design and Analysis I	3 credits
EDUC 6770	Qualitative Methods I	3 credits
EDUC 7780	Qualitative Methods II	3 credits
EDUC 7610	Research Design and Analysis II	3 credits
EDUC 7700	Single Subject Methods & Design	3 credits
EDUC 7650	Longitudinal Research Design & Analysis	3 credits
PSY 7070	Advanced Measurement Theory & Practice	3 credits

Research Practice Core (24 credits)

ETE 7970 Dissertation Research

minimum 24 credits

Additional Degree Requirements

1. Seminar - Students are required to register for ETE 7810 (research seminar) every fall semester during which they are in residence at Utah State University. A minimum of 1 credit and a maximum of 3 credits are applicable to the doctoral degree requirements.
2. Proposal Defense
3. Comprehensive Examination
4. Dissertation Defense/Examination
5. 2 publications submitted to peer reviewed journals
6. Teaching experience including one or more of the following
 - a. One year of experience as a K-12 teacher
 - b. One year of experience as university/college/community college faculty
 - c. Two semesters of guided teaching experience
 - d. Other equivalent experience approved by the department chair and the student's graduate committee
7. Presentation of dissertation research at a regional or national professional society meeting
8. Grant proposal preparation

Appendix B: PROGRAM CURRICULUM Revised Courses

The courses in this group are either new to the Engineering Education Curriculum or have been significantly revised to reflect the new doctoral program's objectives and outcomes.

ETE 7230 Foundations of Engineering and Technology Education (revised) 3 credits

Study of the objectives, legislative foundations, principles, philosophy, impact, and organization of engineering education and technology education. (F, Sp, Su)

ETE 7460 Research Finance and Grant Writing 3 credits

Procedures in financial administration of education and research monies. Budget preparation, budget operation and control, and accounting. In-depth review of steps and techniques needed for grant writing. (F, Sp, Su)

All Program Courses

ETE 6100 Contemporary Issues in Engineering and Technology Education 3 credits

Study of present and future foundational professional developments in engineering and technology education. Students identify and investigate contemporary trends and issues affecting and facing engineering and technology education. (F, Sp, Su)

ETE 6250 Internship 1-6 credits

Advanced instruction through supervised work experience in teaching, supervising, or administering educational or industrial program. (F, Sp, Su)

ETE 6440 Technology and Society 3 credits

(dual listing 4440)

Challenges students to develop an understanding of the dynamic interaction between science, technology, and society. Explores the responsibility of humans to direct the utilization of technology as a creative enterprise. Students critically investigate technological innovations, issues, and impacts on society from a global perspective. (F, Sp)

ETE 6450 Administration and Organization in Engineering and Technology Education 3 credits

Administrative and supervisory techniques for successful operation of technology education and applied technology education programs. (F, Sp, Su)

ETE 6520 Explorations of Engineering Industry 3 credits

Study of contemporary industry, business, and service through a series of site visits. Includes various management and finance methods and techniques. (F, Sp, Su)

ETE 6750 Research Methods and Design in Engineering and Technology Education 3 credits

Introduction to practical research planning and design. Guides students from proposal selection to completed proposal to final research report. (F, Sp, Su)

- ETE 6900 Readings and Conference* 1-3 credits
Advanced individualized study on selected topics in engineering and technology education. Scheduled consultation with faculty member. (F, Sp, Su)
- ETE 6910 Experimental Laboratory* 3 credits
Introduction to elements of a research report through selection and development of experimental study utilizing tools, equipment, materials, and processes for improving programs and teaching techniques. (F, Sp, Su)
- ETE 7010 The Role of Cognition in Engineering and Technology Education* 3 credits
Study of cognitive science and research relating to engineering and technology education. (F)
- ETE 7020 Design Thinking in Engineering and Technology* 3 credits
Engineering design as applied to technology education. (Sp)
- ETE 7030 Engineering Design and Analysis for Engineering and Technology Education* 3 credits
Engineering design methodology for technology education teacher educators. Focuses on science principles and predictive mathematics comprising the engineering sciences needed to solve problems in a design framework that is analytical, predictive, and repeatable. (F)
- ETE 7040 Dynamic and Network Engineering Processes for Technology Education* 3 credits
Examines dynamic and network processes in engineering through the use of simulation software. Students use these techniques to develop standards-based engineering curricular modules for use in grades 6 through 12. (Sp)
- ETE 7400 Occupational Analysis and Curriculum Development** 3 credits
Students learn techniques for conducting an occupational analysis (both job and task analysis) and for developing performance-based or competency-based curriculum. Explores industrial and educational applications for this style of curriculum development.
- ETE 7500 Internationalizing Institutions of Higher Education* 3 credits
Explores the need and methodology of internationalizing higher education institutions, with the purpose of understanding the global society and delivering education worldwide. (F, Sp, Su)
- ETE 7600 Academic Issues and Politics in Higher Education* 3 credits
Study of higher education, the social political impacts, and the role of faculty members in higher education institutions. (F, Sp, Su)
- ETE 7810 Research Seminar* 1-6 credits
Identification of research problems, consideration of research strategies and methods, application of research and statistical concepts in departmental focus, and interaction with faculty. (F, Sp, Su)
- ETE 7900 Independent Study* 1-3 credits
Individually directed reading and conference. Departmental approval required before registration. (F, Su)

ETE 7970 Dissertation Research 1-15 credits
(F, Sp, Su)

ETE 7990 Continuing Graduate Advisement 1-3 credits
(F, Sp, Su)

EDUC 7300 Historical, Social, and Cultural Foundations of Education 3 credits
Examines relationship of modern school in terms of historical, cultural, and social foundations of education. Prerequisites: EDUC 6410, ELED 6020/7020, or permission of instructor. (F)

EDUC 7310 Teaching & Learning Foundations 3 credits
Seminar in which learning theories and teaching models/skills are demonstrated, critically examined, and integrated. Prerequisite: Graduate course in educational psychology or equivalent. (Sp)

EDUC 6600 Research Design and Analysis I 3 credits
Research design and statistical concepts for research in education, human services, and psychology, with emphasis on the selection and interpretation of statistical analyses. Prerequisites: EDUC/PSY 6570, passing score on 6600 Pretest via WebCT, and permission of instructor. Also taught as PSY 6600. (F,Sp,Su)

EDUC 6770 Qualitative Methods I 3 credits
Introduction to qualitative research, including foundations; research designs and strategies of inquiry (case studies, ethnography, phenomenology, grounded theory, biographical, historical, participative inquiry); sampling; fieldwork and data collection; and analysis. Prerequisite: EDUC/PSY 6570. (Sp)

EDUC 7780 Qualitative Methods II 3 credits
(dual listing 6780)
Builds on and applies concepts covered in EDUC 6770, emphasizing analysis of data, critique of qualitative research, and design and implementation of qualitative research. Students registered for 6780 conduct a qualitative research project. Prerequisite: EDUC 6770. (Sp)

EDUC 7610 Research Design and Analysis II 3 credits
Advanced treatment of research design and statistical concepts and issues in educational, human services, and psychological research. Prerequisite: EDUC/ PSY 6600. Also taught as PSY 7610. (F,Sp,Su)

EDUC 7700 Single Subject Methods & Design 3 credits
(dual listing 6700)
Examines single-subject research methodology for applied research in schools, including measurement, design, and analysis issues. Also taught as SPED 7700/6700. (F)

EDUC 7650 Longitudinal Research Design & Analysis 3 credits
Applied longitudinal study design and analysis for research in behavioral and educational sciences. Explores case-control, cohort, cross-over, complex sample, and randomized controlled trial designs.

Examines analytical methods for observed outcomes of various distributions (e.g., Gaussian, Binomial, Poisson). Prerequisite: EDUC/PSY 7610. Also taught as PSY 7650. (Sp)

PSY 7070 Advanced Measurement Theory & Practice 3 credits

Covers psychometric topics, including classical test theory, generalizability theory, item response theory, and issues concerning bias in psychological testing. Prerequisites: PSY 5330/6330, EDUC/PSY 6600. (Sp)

Appendix C: Existing FACULTY

Kurt H. Becker, Ph.D., Professor, Department Head

Technology Education, Texas A&M University

Teaching Specializations – Teacher Education, Computer-Aided Design and Drafting, Construction

Research Specializations – Adult learning cognition, K-12 engineering and technology education professional development, K-12 engineering and technology education curriculum development, and technical training

Ward Belliston, Ph.D., Associate Professor

Vocational Administration and Supervision, Colorado State University, Fort Collins, Colorado

Teaching Specializations – Electricity and Electronics

Research Specializations – Course curriculum and developing innovative teaching materials, electrical engineering education for non electrical engineering majors.

Ning Fang, Ph.D., Associate Professor

Mechanical Engineering, Huazhong University of Science and Technology, China

Teaching Specializations – Engineering mechanics, manufacturing processes, design

Research Specializations – Developing innovative and effective teaching pedagogy and course curriculum, Engineering and Technology Education reform, the retention of freshmen in engineering, K-12 Engineering and Technology Education

Edward Reeve, Ph.D., Professor

Education and Industrial Technology, The Ohio State University, Columbus, Ohio

Teaching Specializations - Technology education, curriculum development, communication technology.

Research Specializations - Developing standards-based curricula for technology and Engineering and Technology Education, improving teaching and learning in engineering and technology educations, internationalizing the curriculum.

Paul Schreuders, Ph.D., Assistant Professor

Biomedical Engineering, University of Texas, Austin

Teaching Specializations – Engineering systems, engineering design, systems Modeling

Research Specializations – Engineering career decisions, teaching engineering design and simulation, classroom group structures and their relationships with success in engineering

Gary A. Stewardson, Ph.D., Associate Professor

Technology Education, University of Maryland, College Park

- Teaching Specializations – Manufacturing, automation and control systems, student assessment, curriculum development, and instructional strategies
- Research Specializations – Developing innovative curriculum utilizing problem solving and design instructional strategies, K-12 engineering education, occupational and task analysis.

New Faculty

New Tenure Track Faculty Member, PhD., Engineering and Technology Education

- Teaching Specializations – Introduction to Engineering, K-12 Engineering Education, Graduate Research Methods
- Research Specializations – K-12 Engineering Education and Technology Education

New Tenure Track Faculty Member, PhD., Civil Engineering

- Teaching Specializations – Statics, Dynamics, CAD, Graduate Engineering Education
- Research Specializations – Engineering Education

New Tenure Track Faculty Member, PhD., electrical Engineering

- Teaching Specializations – Circuits, Electronics, Statics, Graduate Engineering Education
- Research Specializations – Engineering Education

Appendix D: Support Letter from Library



MERRILL-CAZIER LIBRARY
3000 Old Main Hill
Logan, UT 84322-3000
Telephone: (435) 797-2631
Fax: (435) 797-2880

March 4, 2008

To Whom It May Concern,

I am the subject librarian for the Department of Engineering and Technology Education. I have been working with the faculty for the past several years to adjust our Library's books and journals to best meet the teaching and research needs of this department.

In recent years we have been able to cancel journals that no longer served the department well, and acquire new journals more focused on the program. I have worked with faculty to assess their needs, and prioritized the journals they listed as essential to their work. To this end, we were able to acquire four new titles identified as necessary to support the department and its plans to launch a doctoral program in Engineering Education.

Currently, Thomson's *Journal Citation Reports* includes seven journals that pertain to engineering education (listed under the headings of "Education, Scientific Disciplines" and "Engineering, Multidisciplinary." We currently have access to all of these journals. Additionally, faculty and graduate students identified 14 journals upon which they heavily relied. We now have access to all but one of these title, which is available to our faculty and students through Interlibrary Loan. In addition to journals focused on Engineering Education, we have a robust collection of journals in the fields of education, general engineering, and specific fields of engineering.

Access to the journal literature is available through a number of databases, including *Ei Compendex*, the full suite of IEEE publications, the *Web of Science*, *Digital Dissertations*, *Wilson's Education Full Text*, and *ERIC*.

The Library's book collection has been updated. Two years ago, I searched *World Cat*, a composite global database of library holdings, for books pertaining to engineering and technology education. I identified key titles not owned by our library and systematically purchased these to complete our collection. I continue to seek out new monographic publications for this field, and am generally able to purchase any book requested by our faculty.

In summary, the Library is well poised to support a new doctoral program in Engineering Education. If you have any questions about the collections or services we can offer, please contact me.

Sincerely,



Betty Rozum
Associate Director for Technical Services

After reviewing Betty Rozum's assessment, I believe the Merrill-Cazier Library could fully support a Ph.D. program in Engineering Education. Our holdings have been evaluated and greatly improved in this area recently. The collections for engineering topics in general have great depth, as do those for science education.



Steven R. Harris
Collection Development and Management Librarian

Appendix E: Letter of Agreement between College of Engineering
and College of Education and Human Services



COLLEGE OF ENGINEERING
Department of Engineering and Technology Education
6000 Old Main Hill
Logan, UT 84322-6000
Phone: (435) 797-1795
FAX: (435) 797-2567

February 25, 2008

To Whom It May Concern:

This is a letter of agreement between the **College of Education and Human Services** and the **College of Engineering** in support of the proposed **PhD in Engineering Education** through the College of Engineering. Through the proposed program, 12 credits of education courses will be taught by the College of Education and Human Services. The list of courses that will be offered through the College of Education and Human Services are:

EDUC 6600 Design and Analysis I
EDUC 6770 Qualitative Methods I
EDUC 7610 Research Design and Analysis II
EDUC 7780 Qualitative Methods II
EDUC 7650 Longitudinal Research Design & Analysis
EDUC 7700 Single Subject Methods & Design
EDUC 7300 History, Social, and Cultural Foundations of Education
EDUC 7310 Teaching and Learning Foundations
PSY 7070 Advanced Measurement Theory & Practice

The College of Engineering has agreed to provide support for the courses and will negotiate on a yearly basis the cost of instruction for educational research and foundations courses taught by the college of education ~~and human services~~.

Sincerely,

Scott Hinton
Dean of Engineering

Carol Strong
Dean of Education and Human Services