

I. Program Description

The Technology and Engineering Education (TEE) graduate program is administratively housed in the School of Applied Sciences and Technology Education (ASTE) in the College of Agriculture and Applied Sciences.

The program area offers both the doctoral degree and master's degree to students who want to advance their careers and expand their knowledge in the field of technology and engineering education, research, and current practices in pedagogy. The doctoral degree is a research degree and is primarily chosen by people who are seeking teaching/research positions in colleges and universities. The master's degree program is primarily designed for professionals in the areas of Technology and Engineering Education, Career and Technical Education (CTE), and Science, Technology, Engineering, and Mathematics (STEM) fields who want to improve their knowledge and skills in such areas as curriculum development, research methods, current educational theory, and evaluation and assessment.

II. Degrees and Emphasis Options Offered

Master of Science (M.S.) Degree:

The Master of Science (M.S.) degree program is primarily designed for professionals in the areas of Technology and Engineering Education, Career and Technical Education (CTE), and Science, Technology, Engineering, and Mathematics (STEM) fields who want to improve their knowledge and skills in such areas as curriculum development, research methods, current educational theory, and evaluation and assessment.

In this program, students are required to complete a “professional core” of courses (15 credits) that are used to enhance their knowledge of current theory and practice in TEE, CTE, and STEM, and complete the specific requirements of either the Plan A or Plan B option (see below). In consultation with their advisor and/or graduate committee, students will select electives that help them achieve their educational objectives and fulfill the requirements of the graduate program.

Current USU undergraduates may take Master Degree courses provided they meet USU requirements and they must complete a USU Split Form prior to enrolling in classes (see: <http://research.usu.edu/graduateschool/files/uploads/SplitForm.pdf>). The Split Form gives permission for students to register for graduate courses. To use the Split Form, students must be within 30 semester credits of completing bachelor's requirements, have filed an Application for Graduation in the Graduation Office, have a 3.0 or higher GPA, and have applied for admission to the School of Graduate Studies.

Options

Plan A (30 credits): The Plan A “thesis” option requires students to complete a master thesis. This plan is especially beneficial to students preparing for advanced study (e.g., a doctoral

degree). In this option, students are required to complete a statistics course and a minimum of three credits of Thesis Research (TEE 6970).

Plan B (33 Credits): The Plan B “project” option requires students to complete an in-depth “scholarly project” (e.g., a major program or curriculum revision or pilot-testing a new instructional strategy or teaching method.) In this option, students are required to complete the experimental lab course (TEE 6910) and the Master’s Project Course (TEE 6960).

III. Program Mission

The mission of the M.S. graduate program in Technology and Engineering Education at Utah State University (USU) are to enhance the pedagogical and research skills of qualified individuals who are interested in furthering their education careers.

IV. Alignment of Program Mission with Departmental Mission

The mission of the School of Applied Sciences, Technology and Education (ASTE) is to apply the Land Grant University philosophy to teaching & learning, discovery, research, and outreach. The School uses proven educational processes which include formal and informal instruction, experiential learning, leadership, and personal development at an under graduate, graduate, and community based level.

The Technology and Engineering Education program is housed in the school of Applied Sciences, Technology and Education (ASTE) and aligns very well with this School and its other programs, especially those involved in training teachers in agriculture, and in family and consumer science.

In addition, the TEE graduate program works closely with the School of Teacher Education and Leadership (TEAL) in the Emma Eccles Jones College of Education & Human Services. Our mission also aligns closely with the mission of the School of Teacher Education and Leadership and we support their program learning goals and objectives.

V. Program Goals

The program goals of the Technology and Engineering graduate program align with the primary goals of USU’s School of Graduate Studies (see: <http://rgs.usu.edu/graduateschool/htm/about/mission-and-goals>). The specific goals of the TEE graduate program are as follows:

1. Graduate students will obtain focused and comprehensive knowledge in Technology and Engineering Education through classroom instruction, research, and other innovative educational experiences and venues.
2. Graduate students will be prepared to use original ideas and scholarly skills to contribute to the advancement of the field of Technology and Engineering Education.

3. Graduate students will have excellent opportunities to develop and practice professional skills so they can integrate and communicate effectively with the scholarly community in the field of Technology and Engineering Education.
4. Graduate students will be prepared to assume future leadership roles in disseminating and applying knowledge to address local and global educational societal needs.

VI. Program Learning Objectives

1. Develop and implement contemporary technology and engineering curricula used in Technology and Engineering Education and Career and Technical Education.
2. Be able to discuss and debate contemporary issues and trends occurring in the field of Technology and Engineering Education.
3. Be able to effectively develop and use evaluation and assessment instruments to measure student learning and program effectiveness.
4. Describe common administrative and organizational structures used in the managing of secondary education Technology and Engineering classroom and laboratories.
5. Describe basic techniques and methods used in conducting qualitative and quantitative research studies.
6. Describe a variety of inquiry-based learning strategies, including engineering design and the scientific method.
7. Demonstrate the ability to function effectively on teams.
8. Effectively communicate ideas, data through written and electronic means.
9. Recognize the need for, and an ability to engage in life-long learning.
10. Describe the foundational aspects of Technology and Engineering Education.
11. Develop grant proposals and manage grants.
12. Describe the various aspects of student learning in Technology and Engineering Education.
13. Conduct Research.

X. Plan for Measuring the Achievement of Degree and Program Objectives

The first measurement students entering the TEE graduate programs must meet are the requirements of the USU School of Graduate Studies. Admission to the TEE program follows the general USU requirements. In order to be admitted to a graduate degree program at Utah State University, students must meet these minimum requirements:

- Have the requisite degree for your intended program by the time you are matriculated
- 3.0 or higher GPA on your last 60 semester or 90 quarter credits
- Score at or above the 40th percentile on appropriate admissions test.

NOTE: The GRE is required for admittance into the doctoral degree program. For admittance into the master degree program, either the GRE or MAT can be used for admittance.

- Three satisfactory letters of recommendation

In addition, graduate students in the program must follow and meet USU and program area guidelines. Important guidelines include the following:

- A 3.0 GPA is required for all graduate degrees.
- Students have up to 6 years to complete a master's degree.
- For a master's degree, the minimum number of credits required ranges from 30-36; 24 of those credits must be from USU.
- Up to 12 semester graduate-level credits may be transferred to a USU graduate degree from an accredited university if approved by the student's supervisory committee and the graduate school. These transfer credits should have grades of "B" or higher, should not exceed the 6 year limit from degree completion, and should not have been used for another degree.
- A maximum of 12 semester graduate credit hours may be earned before matriculation. Matriculation occurs when you have completed all the admission requirements and have been officially accepted into USU's graduate school and the TEE program. Credits taken beyond 12 semester credits cannot be used to fulfill degree requirements.

Almost all student who complete the master's degree are practicing teachers, At the end of their program, typically during their final defense, they are asked to state how the degree has benefited in their career and they are asked if there are any suggestions to improve the program,

Data Outcomes:

Student Achievements	2008-2009	2009-2010	2010-2011
Number of research/scholarly presentations (or exhibitions, performances, etc. as appropriate) made by students in this program at state, regional, national, or international meetings	3	2	3
Total number of peer-reviewed publications whose primary author is a student in this program	1	2	2
Total number of peer-reviewed publications where a student in this program is a co-author	0	0	0
Number of students from the previous year's graduating class that have found employment in the field			0

TEE students are evaluated through course work and a final defense of an individual final project. The project outcomes target the enhancement of the pedagogical and research skills of individuals addressing programmatic learning objectives. The following abstracts are a collection of student data outcomes who have completed the program.

Roner, Kevin C., "Improving Automotive Troubleshooting Skills" (2014). *All Graduate Plan B and other Reports*. Paper 402.

Abstract

This project gathered and analyzed data for two cohorts of students at Weber State University. The final performance exam data from the engine controls course and the Automotive Service Excellence certification results were gathered on each student from two cohorts. A skills survey was developed to determine each student's skill level. The survey was delivered to the students and their mentor technicians in the field. The data was analyzed to identify correlating items across the data sets. Those correlations were used to determine which lessons within the course in the content area of diagnostic troubleshooting required improvement. The project resulted in recommendations with examples for improving the diagnostic troubleshooting content of the Toyota Engine Controls course at Weber State University.

Thompson, Jeremy Miles, "A Review Of Steel Content Taught In U.S. University Construction Management Programs" (2014). *All Graduate Plan B and other Reports*. Paper 401.

<http://digitalcommons.usu.edu/gradreports/401>

Abstract

The results of this study indicate that a majority of students are being taught about steel construction, however, if even five schools do not cover these topics it could mean up to 100 students per year that are not being prepared to enter the commercial and industrial construction industry. It is recommended that construction management 31 programs across the United States do all they can to incorporate AISC recommended material to at least the theory level, and preferably to the practice level.

Porter, Joseph R., "An Investigation in the Use of Memorizing as a Learning Method When Teaching Measurement in a Technology Education Classroom" (2014). *All Graduate Plan B and other Reports*. Paper 417.

<http://digitalcommons.usu.edu/gradreports/417>

Abstract

The purpose of this research project was to determine if focusing the student's effort on memorizing the fractions of an inch would increase their ability to convert their learning into functional knowledge. Based on the results that were described previously, students who were taught using the conceptual understanding method were able to score higher on the posttest than the group who were taught using the memorization method. It is recommended that both methods be used in order to achieve the greatest results. Students should be involved in memorization exercises as a lead-in to the conceptual understanding lesson. As the student is spending time memorizing the fundamental divisions of the inch, the conceptual understanding lesson will reinforce the need for this knowledge. Further research would be needed to verify the hypothesis of the researcher that both methods combined would increase student learning and retention.

Ames, R. T. (2014). *A survey of Utah's public secondary education science teachers to determine their feelings of preparedness to teach engineering design*. Retrieved from <http://dist.lib.usu.edu/login?url=http://search.proquest.com/docview/1658771529?accountid=14761>

Abstract

The Next Generation Science Standards were released in 2013 and call for the inclusion of engineering design into the science classroom. This integration of science and engineering is very exciting for many people and groups in both fields involved, but a good bit of uncertainty remains about how prepared science teachers feel to teach engineering design. This study analyzes the history of science standards leading up to the Next Generation Science Standards, establishes key components of the engineering design, and lays the background for the study detailed in this report. A survey was given to several hundred public secondary science teachers in the state of Utah in which respondents were asked to report their feelings of preparedness on several aspects of engineering design. The findings of the study show that Utah teachers do not feel fully prepared to teach engineering design at the present time (2014).

Reutzell, C. J. (2008). *Effective practices of project lead the way partnership teams*. Retrieved from <http://dist.lib.usu.edu/login?url=http://search.proquest.com/docview/193666617?accountid=14761>

Abstract

The purpose of this study was to gather information from Project Lead The Way (PLTW) partnership team experts. This project follows the methodology of a modified Delphi study. A review of literature in the areas of curriculum development, pre-college engineering, and the Delphi research technique provided the background for the structure utilized. Top programs from across the country were questioned to identify and come to a consensus on top components essential to developing and utilizing a successful PLTW partnership team. The components were categorized into two lists: effective practices utilized to make a program successful and effective practices employed by team coordinators to make a leadership team successful. The initial

information provided was revised through the blind collaboration of 17 experts. Information gathered between each revision was coded and analyzed to achieve two final lists.

Williams, S. E. (2009). *An experimental comparison of middle school students' motivation and preference toward text- and graphic-based programming*. Retrieved from <http://dist.lib.usu.edu/login?url=http://search.proquest.com/docview/305011823?accountid=1476>

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Abstract

The purpose of this study was to compare seventh-grade students' motivation and preference toward text-based programming using Visual Basic, and graphics-based programming using Robolab. Motivation was defined by the *My Class Activities* questionnaire using the dimensions of interest, challenge, choice, and enjoyment. Preference was determined through team and individual student choice. This study was conducted with 122 students from three 6-week technology education classes. This study examined two hypotheses. First, middle school students will be more motivated when using a graphics-based programming language than text-based as measured by the *My Class Activities* survey. The second hypothesis for this study was that middle school students preferred using graphic-based programming more than using text-based programming in an introductory experience. Student preference was identified individually and within a team environment.

Deceuster, A. I. (2009). *Investigation of joining micro-foil materials with selective laser sintering and laser powder deposition* (Order No. 1468203). Available from ProQuest Dissertations & Theses Global. (305013372). Retrieved from <http://dist.lib.usu.edu/login?url=http://search.proquest.com/docview/305013372?accountid=1476>

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Abstract

Continuous and pulse selective laser sintering and laser powder deposition were used to find a solution to the manufacturing of micro-foil lattice structured components. A full factorial test matrix was used for each process to determine the processes capability to produce continuous tracks for joining the micro-foil materials. The samples were evaluated for dimensional profiles, distortion, and cycle times, to develop selection criteria for implementation of the processes into industry. The selective laser sintering processes were able to join the micro-foil materials into lattice structures with continuous tracks. The laser powder deposition processes were not able to properly join the micro-foil materials into lattice structures. The end results showed that micro-foil lattice structures can be produced using continuous and pulse selective laser sintering.

IX. Strengths, Weaknesses and Recommendations

A graduate degree in Technology and Engineering Education (TEE) at Utah State University (USU) prepares students to become better teachers and leaders in the field and has been designed for those who want to advance their careers and expand their knowledge in technology and engineering education and current practices in pedagogy. The master's degree program is primarily designed for professionals in the areas of Technology and Engineering Education, Career and Technical Education (CTE), and Science, Technology, Engineering, and Mathematics (STEM) fields who want to improve their knowledge and skills in such areas as curriculum development, research methods, current educational theory, and evaluation and assessment.

The field of Technology and Engineering Education is a high demand field and the undergraduate program consistently has a 100% placement rate for those who choose teaching as a career. In the graduate program, we experience the same success.

Strengths

- Highly qualified faculty (i.e., Gary Stewardson and Edward Reeve) with diverse philosophical backgrounds. Notable characteristics of these faculty members include:
 - K-12 teaching experience in Technology and Engineering Education.
 - More than 25 years of research and teaching experience in technology and engineering education at the university level.
 - Real-world industry experience.
 - International Consultants in the areas of training and development, developing educational materials, and working with Government and Non-Government Agencies.
 - Long-standing involvement in the Profession of Technology and Engineering Education. For example, Edward Reeve is currently on the International Technology and Engineering Educators (ITEEA) Board of Directors and he recently completed his three-year term as President of the Council on Technology and Engineering Teacher Education (CTETE). Gary Stewardson is currently chairing ITEEA's program review committee for its national conference.
- Up-to date laboratories that promote technological literacy in the designed world. For example, notable new equipment in these labs include CNC machines, a 3D-printer, and a laser-engraver.
- Small size classes that promote one-one interactions with the instructor.
- Approachable Faculty members who “care” about their students succeeding.
- Commitment to the community through outreach activities. For example, currently the program supports an after school “high school design academy” that supports students learning how to build and compete in the area of VEX robotics.

- Face-to-Face Master's Degree program that is offered in a unique one-month summer program of classes that allows students to complete the degree in three summers. This program brings teachers from around the region to the USU campus in the summer. Approximately 20 students enrolled in the Master's degree program.

- Excellent working relationships with all colleges (e.g., engineering) and departments (e.g., engineering education) on campus. This relationship helps in collaborative program efforts, including serving on their graduate student committees.
- Nationally Recognized Program by our peers
- Recently updated TEE curriculum that reflects the current needs of the profession.
- Program area website.
- Full-time graduate students who help the program through teaching, research, and service activities.

Weaknesses

- Low number of full-time Master's degree students. At times, the two faculty member's time can be spread quite thin because of other professional and university commitments (e.g., serving on graduate committees, university committees, etc.)
- Relationships with the State Technology and Engineering Education Specialist and the other school in the state (i.e., BYU) that offers the same degree could be strengthened.
- Faculty involvement in the state technology and engineering education association could be better strengthened.
- Better tracking data of graduates of the program is needed. Re-establish exit interview practice of graduates.
- No-online TEE courses or off-campus TEE courses offered.
- An in-depth review is needed of the goals and objectives of each of the TEE courses offered in the program.

Recommendations

- Develop an active recruitment plan to get new graduate students into the program.
- For low enrollment classes, team up with similar classes being taught in agriculture and/or family and consumer science.
- Hire another ½ of full-time faculty member in the program.
- Build relationships with state organizations and BYU.
- Build a system to track program graduates.
- Conduct an in-depth program review.