

(NEW GRADUATE INITIATIVES)**PROPOSAL PROCEDURES CHECKLIST**

Academic units should adhere to the following procedures when requesting new curricular initiatives (degrees, concentrations or certificates).

Obtain the required approval from the Office of the Provost to move the initiative forward for internal ASU governance reviews/approvals.

- Establishment of new curricular initiative requests; degrees, concentrations, or certificates
- Rename requests; existing degrees, concentrations or certificates
- Disestablishment requests; existing degrees, concentrations or certificates

Submit any new courses that will be required for the new curricular program to the Curriculum ChangeMaker online course approval system for review and approval.

- Additional information can be found at the Provost's Office Curriculum Development website: [Courses link](#)
- For questions regarding proposing new courses, send an email to: courses@asu.edu

Prepare the applicable proposal template and operational appendix for the proposed initiative.

- New degree, concentration and certificate templates (contain proposal template and operational appendix) can be found at the Provost's Office Curriculum Development website: [Academic Programs link](#)

Obtain letters or memos of support or collaboration. (if applicable)

- When resources (faculty or courses) from another academic unit will be utilized
- When other academic units may be impacted by the proposed program request

Obtain the internal reviews/approvals of the academic unit.

- Internal faculty governance review committee(s)
- Academic unit head (e.g. Department Chair or School Director)
- Academic unit Dean (will submit approved proposal to the curriculumplanning@asu.edu email account for further ASU internal governance reviews (as applicable, University Graduate Council, CAPC and Senate)

Additional Recommendations - All new graduate programs require specific processes and procedures to maintain a successful degree program. Below are items that Graduate Education strongly recommends that academic units establish after the program is approved for implementation.

Set-up a Graduate Faculty Roster for new PhD Programs – This roster will include the faculty eligible to mentor, co-chair or chair dissertations. For more information, please go to http://graduate.asu.edu/graduate_faculty_initiative.

Establish Satisfactory Academic Progress Policies, Processes and Guidelines – Check within the proposing academic unit and/or college to see if there are existing academic progress policies and processes in place. If none have been established, please go to http://graduate.asu.edu/faculty_staff/policies and scroll down to the **academic progress review and remediation processes** (for faculty and staff) section to locate the reference tool and samples for establishing these procedures.

Establish a Graduate Student Handbook for the New Degree Program – Students need to know the specific requirements and milestones they must meet throughout their degree program. A Graduate Student Handbook provided to students when they are admitted to the degree program and published on the website for the new degree gives students this information. Include in the handbook the unit/college satisfactory academic progress policies, current degree program requirements (outlined in the approved proposal) and provide a link to the Graduate Policies and Procedures website. Please go to http://graduate.asu.edu/faculty_staff/policies to access Graduate Policies and Procedures.

Check Box Directions – To place an “X” in the check box, place the cursor on the left-side of the box, right click to open the drop down menu, select *Properties*, under *Default value*, select *Checked* and then select *Ok*.



ARIZONA STATE UNIVERSITY
PROPOSAL TO ESTABLISH A NEW GRADUATE DEGREE

This template is to be used only by programs that have received specific written approval from the University Provost's Office to proceed with internal proposal development and review. A separate proposal must be submitted for each individual new degree program.

DEGREE PROGRAM

College/School(s) offering this degree: Ira A. Fulton Schools of Engineering

Unit(s) within college/school responsible for program: The Polytechnic School

If this is for an official joint degree program, list all units and colleges/schools that will be involved in offering the degree program and providing the necessary resources: N/A

Proposed Degree Name: Engineering Education Systems and Design

Doctoral Degree Type: Doctor of Philosophy (PhD)

Proposed title of major: Engineering Education Systems and Design

Is a program fee required? Yes No

Requested effective term: Spring and year: 2016
(The first semester and year for which students may begin applying to the program)

PROPOSAL CONTACT INFORMATION

(Person to contact regarding this proposal)

Name: Ann McKenna

Title: Director, The Polytechnic School

Phone: 480-727-5121

email: ann.mckenna@asu.edu

DEAN APPROVAL

This proposal has been approved by all necessary unit and College/School levels of review, and the College/School(s) has the resources to offer this degree program. I recommend implementation of the proposed degree program. (Note: An electronic signature, an email from the dean or dean's designee, or a PDF of the signed signature page is acceptable.)

College Dean name: James S. Collofello

College Dean Signature James S. Collofello Date: 3/12/2015

**ARIZONA STATE UNIVERSITY
PROPOSAL TO ESTABLISH A NEW GRADUATE DEGREE**

This proposal template should be completed in full and submitted to the University Provost's Office [mail to: curriculumplanning@asu.edu]. It must undergo all internal university review and approval steps including those at the unit, college, and university levels. A program **may not** be implemented until the Provost's Office notifies the academic unit that the program may be offered.

DEGREE PROGRAM INFORMATION

Doctoral Type: PhD

Proposed title of major: Engineering Education Systems and Design

1. PURPOSE AND NATURE OF PROGRAM:

A. Brief program description –

Engineering Education Systems and Design (EESD) is a transdisciplinary PhD program aimed at advancing understanding of the engineering education ecosystem. The goal of EESD is to enable long-lasting improvement of the learning process and infrastructure in engineering education at all levels by emphasizing the study of education as a complex ecosystem that takes into account the multiple inputs, outputs, and interactions within an educational setting.

The program will prepare students to critically analyze and conduct research in engineering education and will prepare students to take competitive positions in top-tier research institutions as exemplary scholars and teachers, and as leaders in engineering education in a variety of education settings (e.g. universities, science centers, government agencies, museums, industry professional development).

A typical student will enter the program with a masters degree in an engineering or related discipline and will select from areas of specialization such as education system design; educational policy and implications; learner analytics; design of online educational environments; and assessment of impact of educational innovations.

B. Will concentrations be established under this degree program? Yes No

2. PROGRAM NEED - Explain why the university should offer this program (include data and discussion of the target audience and market).

The proposed degree is needed to help address the increasing demand for a national focus on Science, Technology, Engineering and Mathematics (STEM) education, particularly engineering education both at the K-12 and higher education levels. The National Academy of Engineering, in 1999, recognizing engineering education as a then emerging field, established the Center for the Advancement of Scholarship on Engineering Education (CASEE) as a mechanism to foster a climate of continuous improvement in engineering education. There is a decline in high school students' interest in careers in science and engineering resulting in a decline in Engineering enrollment, both undergraduate and graduate, and engineering doctorates have declined in recent years and are still below the levels of the 1980s (Science and Engineering Indicators 2008). The National Science Board (2007) report, "Moving Forward to Improve Engineering Education" identified the following areas as key challenges to engineering education needing attention: public perception of engineering, recruitment and retention of students in engineering majors, responsiveness of engineering education to change in the global environment, and needs for additional data to support policy and planning. This proposed degree would provide training and scholarship to help address these national imperatives.

Using design and systems thinking with a focus on developing solutions to identified needs in context, along with principles of science and mathematics, engineering brings together multiple disciplines to address advancing society. Engineering has existed as long as humans have needs and it is fundamentally a human endeavor. The National Science Board (2007) stated that "The next generation of engineers will be challenged to find holistic solutions to population, energy,

environment, food, water, terrorism, housing, health, and transportation problems...it is an exciting time to be in engineering." This statement characterizes the interdisciplinary nature of the field, its importance to our citizenry, and the need to develop public intellectuals who can address the grand challenges of the 21st century.

The National Science Foundation's Directorate for Engineering has developed Engineering Education Programs (EEC) aimed at the following: Engineering Education encourages the integration of engineering research and education to accelerate technological and educational innovation and improve the quality and diversity of engineering graduates entering the technical workforce. EEC encourages partnerships that infuse both research and education with new knowledge from multiple disciplines, take advantage of new understanding of how students learn, and focus on engineered systems. The objective is to graduate engineering leaders with a global outlook and the ability to adapt to the rapidly evolving technical environment in industry, academe, and society. It also supports the active involvement of K-12 teachers and community college faculty in engineering research in order to bring knowledge of engineering and technological innovation into their classrooms, (National Science Foundation, 2009).

The Engineering Education Systems and Design doctoral program will enable students to develop robust knowledge of how to model, characterize, analyze, design, and study an education ecosystem. Students will develop knowledge in learning theory, curriculum design, assessment, evaluation, education systems modeling, educational policy, design processes, and qualitative and quantitative research methods in engineering education. Graduates will be prepared to research and study the impact of engineering education programs, pursue funding for engineering education and research efforts, enhance the engineering education field informed by research on how people learn, contribute to the science and design of assessment and evaluation, facilitate learning in varied contexts, and change engineering education in response to global challenges.

There is broad faculty interest across the Ira A. Fulton Schools of Engineering in participating in this degree program. Moreover, we have faculty who are nationally renowned for their work in engineering education, and have a track record of success in receiving funding to advance scholarship in this area. The level of cross-school faculty involvement is represented by the list of faculty included in section 7.

Nationally, we are aware of four institutions that offer a Ph.D. level degree specifically for Engineering Education. They are:

Virginia Tech: <http://www.enge.vt.edu/>

Purdue University: <https://engineering.purdue.edu/ENE/Academics/Graduate/Doctorate/requirements>

Utah State University: <http://www.eed.usu.edu/htm/graduate-program/degree-information>

Clemson University: <http://www.clemson.edu/ese/phd/>

Two types of related programs also exist: 1) Engineering Ph.D. level programs with Engineering Education Concentrations (e.g. Louisiana Tech: <http://coes.latech.edu/grad-programs/doctoral-degrees/phd-engineering.php>), and 2) STEM Education Ph.D. level programs allowing students to choose "E" or Engineering as their focus (e.g. Tufts University: <http://ase.tufts.edu/education/programs/research/STEM.asp>)

With a doctoral degree in Engineering Education Systems and Design, Arizona State University will be among the top-tier institutions in the nation that prepare experts in Engineering Education, with a specific focus on design and systems thinking, and on education as an ecosystem with multiple interacting components, thereby influencing this emerging field. As there are very few national level graduate engineering education programs, there is a large pool of prospective students available for recruitment.

3. IMPACT ON OTHER PROGRAMS - Attach any letters of collaboration/support from impacted programs. (see Checklist coversheet)

Doctoral programs focused on Engineering Education are currently not available at ASU. The PhD in Aerospace Engineering and the PhD in Mechanical Engineering both have concentrations in Engineering Education that are closed to applications and will be disestablished in the future.

We have also included a letter of support from the Mary Lou Fulton Teachers College.

4. **PROJECTED ENROLLMENT** - How many new students do you anticipate enrolling in this program each year for the next five years? Please note, The Arizona Board of Regents (ABOR) requires nine masters and six doctoral degrees be awarded every three years. Thus, the projected enrollment numbers must account for this ABOR requirement.

The projected enrollment in the PhD program in Engineering Education Systems and Design is based on the number of core faculty who conduct funded research in this area (currently approx. 20), the relative numbers of PhD students that the faculty are expected to supervise, and projected growth rates in faculty numbers and demographics. It is assumed that the program will reach equilibrium after four years, at which time junior faculty will continuously supervise 2 PhD students, and senior faculty will average 1. A four-year graduation rate among the students is assumed, as is a 10% attrition rate, and the projected numbers have been rounded to the nearest multiple of 5. The result is shown in the following table:

5-YEAR PROJECTED ANNUAL ENROLLMENT					
Please utilize the following tabular format.	1st Year	2nd Year (Yr 1 continuing + new entering)	3rd Year (Yr 1 & 2 continuing + new entering)	4th Year (Yrs 1, 2, 3 continuing + new entering)	5th Year (Yrs 1, 2, 3, 4 continuing + new entering)
Number of Students Majoring (Headcount)	10	15	20	30	35

5. **STUDENT LEARNING OUTCOMES AND ASSESMENT:**

- A. **List the knowledge, competencies, and skills** students should have attained by graduation from the proposed degree program. (You can find examples of program Learning Outcomes at <http://www.asu.edu/oue/assessment.html>).

Graduates of the Ph.D. in Engineering Education Systems and Design will:

1. Achieve a depth of methodological and theoretical knowledge relevant to carrying out engineering education research in their area of interest
2. Demonstrate their knowledge of the current state of the engineering education ecosystem and have the ability to identify important research topics to pursue in the field.
3. Apply systematic design and entrepreneurship methods to define, develop, and produce an engineering education innovation
4. Demonstrate expertise in statistical methods for conducting engineering education research
5. Critically analyze qualitative engineering education research from a range of methodological and epistemological traditions
6. Develop a portfolio of research accomplishments that position them to be competitive for appropriate level of employment opportunities for their career goals. Such a portfolio would include the dissertation, publications in impactful journals, conference publications, and participation in the development of research proposals that PhD students will naturally assemble as they complete their studies.

- B. **Describe the plans and methods to assess** whether students have achieved the knowledge, competencies and skills identified in the Learning Outcomes. (You can find examples of assessment methods at <http://www.asu.edu/oue/assessment.html>).

1. Graduates of the Ph.D. in Engineering Education Systems and Design will achieve a depth of methodological and theoretical knowledge relevant to carrying out engineering education research in their area of interest.
 - a. Outcome 1: Doctoral dissertation

- i. Performance criteria: 80% of doctoral dissertations will receive a rating of “Very Good” or “Outstanding” for methods, using the Lovitts (2007)* rubric for engineering/education (see citation at end of this section)
 - b. Outcome 2: Publications
 - i. Performance criteria: 100% of students will have published at least one article in a reputable journal prior to graduation.
- 2. Graduates of the program will demonstrate their knowledge of the current state of the engineering education ecosystem and have the ability to identify important research topics to pursue in the field.
 - a. Outcome 1: Dissertation prospectus/proposal
 - i. Performance criteria: 75% or more of students will earn a rating of “Meets Expectations” or better on the proposal.
 - b. Outcome 2: “Issues paper” in EGR 574
 - i. Performance criteria: 80% or more of students will earn a grade of B on issues paper
 - c. Outcome 3: “Systems paper” in EGR 574
 - i. Performance criteria: 80% or more of students will earn a grade of B on systems paper
- 3. Graduates of the program will demonstrate ability to apply systematic design and entrepreneurship methods to define, develop, and produce an engineering education innovation
 - a. Outcome 1: “Innovation project” in EGR 535
 - i. Performance criteria: 80% or more of students will earn a grade of B on the project report
 - ii. Performance criteria: 80% or more of students will earn a grade of B on the project prototype
- 4. Graduates of the program will demonstrate expertise in statistical methods for conducting engineering education research.
 - a. Outcome 1: Exams in EGR 572
 - i. Performance criteria: 80% or more of students will earn a grade of B on each of the exams in EGR 572
 - b. Outcome 2: Report 4-- Final data collection instrument in EGR 673
 - i. Performance criteria: 80% or more of students will earn a grade of B on report 4
 - c. Outcome 3: Report 5-- Findings from final project analysis in EGR 673
 - i. Performance criteria: 80% or more of students will earn a grade of B on report 5
- 5. Graduates of the program will demonstrate ability to critically analyze qualitative engineering education research from a range of methodological and epistemological traditions.
 - a. Outcome 1: Theory Paper EGR 565
 - i. Performance criteria: 80% or more of students will earn a grade of B on the theory paper
 - b. Outcome 2: Qualitative research proposal in EGR 565
 - i. Performance criteria: 80% or more of students will earn a grade of B on the qualitative research proposal
- 6. Graduates of the program will have developed a portfolio of research accomplishments that position them to be competitive for appropriate level of employment opportunities for their career goals.
 - a. Outcome 1: Job placement
 - i. Performance criteria: 70% or more will find employment in positions in their field of study within one year of graduation
 - ii. Performance criteria: 85% of alumni survey respondents will report that they are currently employed in a field that is related or closely related to their degree program.

*Lovitts, Barbara E. (2007). *Making the Implicit Explicit: Creating Performance Expectations for the Dissertation*, Stylus Publishing LLC, Sterling, VA.

6. **ACCREDITATION OR LICENSING REQUIREMENTS (if applicable):** Provide the names of the external agencies for accreditation, professional licensing, etc. that guide your curriculum for this program, if any. Describe any requirements for accreditation or licensing.

N/A

7. **FACULTY, STAFF, AND RESOURCE REQUIREMENTS:**

A. **Faculty**

- i. **Current Faculty** - List the name, rank, highest degree, area of specialization/expertise and estimate of the level of involvement of all current faculty members who will teach in the program.

Note: (a): Committee Chair, (b): Co-Chair or member and (c): Teach courses

The core faculty in the program will be based in the Polytechnic School, and will be responsible for teaching the core, required courses. However, the nature of the Ira A. Fulton Schools of Engineering is that faculty with relevant expertise may have home appointments within other schools. The list below represents the list of faculty who have expressed interest in being affiliated with this PhD program, and have the desire, expertise, and funding to supervise students in the program. All listed have qualifications to chair or co-chair but only a subset of these faculty will teach the core courses. Those designated as teaching in the core have specific degrees, training and/or experience that qualify them to teach the fundamentals of engineering education research.

Name	Rank	Expertise	Level of Involvement
Allenby, Brad, PhD	Professor	Earth systems engineering, management industrial ecology science and technology policy	a, b
Amresh, Ashish, PhD	Assistant Professor	Serious games research, computer graphics, human-computer interaction, computer science education, K-12 STEM education	a, b
Atkinson, Robert, PhD	Associate Professor	Personalized learning, social media, learner analytics, mobile learning, cognitive science, usability testing, human-computer interaction	a, b and c
Bansal, Srividya, PhD	Assistant Professor	Semantic computing; big data integration; semantics-based solutions for outcome-based instruction design in STEM education; delivery models for Software engineering education	a, b
Bekki, Jennifer, PhD	Assistant Professor	Discrete event simulation methodology, modeling and analysis of manufacturing systems, online learning, educational data mining / learner analytics, engineering student persistence, STEM graduate students	a, b and c
Branaghan, Russell, PhD	Associate Professor	Human factors in product design; Empirically derived semantic networks; knowledge organization and human expertise; cognitive processes underlying creativity	a, b and c
Brunhaver, Samantha, PhD	Assistant Professor	Use Inspired Design, engineering education, new pedagogical tools for improving student learning in statics and mechanics	a, b and c

Name	Rank	Expertise	Level of Involvement
Burrows, Veronica, PhD	Associate Professor	Engineering education (reflective practice; design learning; concept inventories); applied surface science (surface chemistry of semiconductors; chemical sensors)	a, b
Carberry, Adam, PhD	Assistant Professor	Self-efficacy, epistemological beliefs, design education, modeling in engineering, standards-based grading, service-learning	a, b and c
Cooke, Nancy, PhD	Professor	Cognitive engineering, knowledge elicitation, cognitive task analysis, team cognition	a, b and c
Craig, Scotty, PhD	Assistant Professor	Intersections of emotions and cognition, human discourse, vicarious learning, question asking, multimedia educational environments including animated pedagogical agents and human-computer interactions.	a, b and c
Csavina, Kristine, PhD	Clinical Assistant Professor	Motion analysis of human motion in movement disorders, orthopedics and sports, engineering education research in student learning	b and c
Ganesh, Tirupalavanam, PhD	Assistant Dean and Associate Research Professor	Engineering education, innovations in formal and informal k-12 engineering education, graphical exploratory data analysis, visual data	b and c
Gary, Kevin, PhD	Associate Professor	Software Architecture and Design, open source software, agile methods, applications in healthcare (image-guided surgery and mHealth), and e-learning	a, b
Gibson, G. Edward, PhD	Professor	Front end planning, risk management, construction productivity, organizational change, dispute resolution	a, b
Grau, David, PhD	Assistant Professor	Sustainable design and construction, information technologies, lean construction	a, b
Gray, Rob, PhD	Associate Professor	Vision and perceptual motor control in driving, flying, and sports; simulation; multisensory integration	a, b and c
Halden, Rolf, PhD	Professor	Bioremediation of environmental contaminants, Pharmaceuticals and personal care products, Environmental proteomics, Public health preparedness	a, b
Henderson, Mark, PhD	Professor	Global product design, social entrepreneurship, biofuels, clean water, strategic product development	a, b and c
Hsiao, Sharon, PhD	Assistant Professor	Adaptive technology, personalized learning, interactive educational systems	a, b
Johnson, Nathan, PhD	Assistant Professor	Complex energy system dynamics, micro-grid modeling and optimization, hybrid thermal-power systems, designing for sustainability, multidisciplinary design, global development	a, b and c

Name	Rank	Expertise	Level of Involvement
Jordan, Shawn, PhD	Assistant Professor	Context in design, success and design ownership in virtual teams, human-centered design, cross-disciplinarity, creativity, innovation, informal education, K-12 STEM outreach, virtual competitions, and engineering in mass media	a, b and c
Kellam, Nadia, PhD	Associate Professor	Engineering professional identity formation, the role of emotion in student learning, synergistic learning, faculty change, and complex systems	a, b and c
Krause, Stephen, PhD	Professor	Engineering education, engineering outreach to K-12, education materials characterization	a, b
Lande, Micah, PhD	Assistant Professor	Engineering innovation, design	a, b and c
Landis, Amy, PhD	Associate Professor	Industrial ecology, byproduct synergies, biofuels, biopolymers	a, b
McKenna, Ann, PhD	Professor	Design education, impact and diffusion of educational innovations, adaptive expertise in design innovation, virtual communities of practice	a, b and c
Middleton, Jim, PhD	Professor	Student learning of mathematical concepts; motivation and mathematics learning; application of technology to mathematics teaching and learning.	a, b and c
Morrell, Darryl, PhD	Associate Professor	Engineering pedagogy, engineering program development, stochastic decision theory	a, b and c
Nelson, Brian, PhD	Associate Professor	Learning theory, instructional design, educational technology, game-based learning environments, simulations, multimedia, collaborative learning	a, b
Nielsen, David, PhD	Assistant professor	Developing microbial platforms and biotechnologies to convert renewable resources into useful fuels and chemicals	a, b
Niemczyk, Mary, PhD	Associate Professor	Metacognition and self-regulation	a, b and c
Phelan, Pat, PhD	Professor	Energy applications including nanofluids, solar cooling and thermal storage, waste heat utilization, thermogalvanic energy conversion	a, b
Phillips, Stephen, PhD	Professor	Applications and integration of microsystems including microelectromechanical systems (MEMS), microactuators, neural recording and neural stimulation; applications of systems and control including adaptive control	a, b
Rajan, S.D., PhD	Professor	Design optimization, high-performance and parallel computations, automated design methodologies, engineering product development	a, b

Name	Rank	Expertise	Level of Involvement
Ralston, Laurie, PhD	Lecturer	Online learning & educational technology, Student-owned technology in higher education, Creative thinking/reflection, critical thinking, developing creativity skills in students	c
Ramakrishna, B, PhD	Associate Professor	Materials, humanitarian engineering	a, b and c
Reisslein, Martin, PhD	Professor	Multimedia networking over wired and wireless network, video traffic characterization, optical networking, and engineering education	a, b
Rogers, Brad, PhD	Associate Professor	Engineering in the Developing World, Conventional and Alternative Energy Conversion Systems, Biofuel Systems, Global Design and Engineering, Heat Transfer, Thermodynamics, Experimental and Computational Fluid Mechanics	a, b and c
Seager, Tom, PhD	Associate Professor	Ethics education for sustainable engineers, environmental impacts of alternative energy	a, b
Shah, Jami, PhD	Professor	Computer aided design and analysis, Design computing & software development, Artificial Intelligence & Knowledge based Systems (AI/KBS) applied to design/manufacturing	a, b
Skromme, Brian, PhD	Professor	Compound semiconductor materials and devices	a, b
Sohoni, Sohum, PhD	Assistant Professor	Computer architecture, performance analysis, computer science education, engineering education	a, b
Sullivan, Kenneth, PhD	Associate Professor	Performance measurement, Risk management, best value contracting, accountability systems, facility management	a, b
Takahashi, Timothy, PhD	Professor of Practice	Fixed-wing aircraft design, aerodynamics, aircraft performance, multi-disciplinary optimization, legal aspects of aviation	b, c
Wiesel, Avi, PhD	Associate Professor	Buildability modeling, construction education, information technology in construction	a, b
Wu, Bing, PhD	Assistant Professor	Multimodal human-machine interactions in the applied context of medical and industrial settings	a, b and c

- ii. **New Faculty** - Describe the new faculty hiring needed during the next three years to sustain the program. List the anticipated hiring schedule and financial sources for supporting the addition of these faculty members.

This program will be supported with current faculty and new faculty hired under the existing hiring plan. The addition of this program will aid in recruitment of highly qualified junior faculty by providing opportunities for professional growth that are closely aligned with the other schools in the college.

- iii. **Administration of the program** - Explain how the program will be administered for the purposes of admissions, advising, course offerings, etc. Discuss the available staff support.

Students enrolled in the Ph.D. in Engineering Education Systems and Design program must satisfy all University and the program's admission criteria. Administration of the program will be the responsibility of the Graduate Program Chair for the Engineering program in the Polytechnic School. The EESD Graduate Program Committee, elected by the faculty, will have the responsibility of screening applicants to the Ph.D. program and sending these recommendations to Graduate Education, as well as Director of the Polytechnic School and the office of the Dean of the Ira A. Fulton Schools of Engineering. This committee is likewise responsible for assuring the integrity of the program distribution of monetary awards including internal scholarships and graduate teaching and research assistantships that are not directly funded by faculty research programs.

The existing graduate advising staff of the Polytechnic school will provide procedural advising for the program, and the Engineering Graduate program chair will coordinate technical and programmatic advising. The Polytechnic school will provide additional staff support for the program including preparing and disseminating materials such as recruiting information, graduate applications, admission decisions and evaluations of student progress.

B. Resource requirements needed to launch and sustain the program: Describe any new resources required for this program's success such as new staff, new facilities, new library resources, new technology resources, etc

No new resources will be required.

8. COURSES:

A. Course Prefix(es): Provide the following information for the proposed graduate program.

i. Will a new course prefix(es) be required for this degree program?

Yes No

ii. If yes, complete the [Course Prefixes / Subjects Form](#) for each new prefix and submit it as part of this proposal submission.

B. New Courses Required for Proposed Degree Program: Provide course prefix, number, title, and credit hours and description for any new courses required for this degree program.

EGR 565 Qualitative Methods for Engineering Education Research (3 cr)

This course provides a deep, empirical exposure to interpretive methods in engineering education research. EGR 565 is a pre-requisite for EGR 671.

EGR 572 Quantitative Methods for Engineering Education Research (3 cr)

Introduction to the specific quantitative analysis techniques used in the field of engineering education, with special focus on instrument design, ANOVA, and multiple regression. EGR 572 is a co-requisite for EGR 673

EGR 574 Engineering Education Systems in Context (3 cr)

This course provides a systems understanding of current trends in engineering education research to engage engineering education research graduate students with the latest developments in the field in which they will situate their research projects. Students will be advised to take this course in the first semester of the program.

EGR 598 Topic: Mixed Methods for Engineering Education Research (3 cr)

This course addresses the theory and practice of mixing inquiry methodologies in engineering education research.

EGR 602 Principles of Independent Research (3 cr)

In depth discussion of research topics developed and presented by students.

EGR 671 Applications of Qualitative Methods for Engineering Education Research (3 cr)

This course provides a deep, situated exposure to making and handling data in in qualitative engineering education research projects.

EGR 673 Applications of Quantitative Methods for Engineering Education Research (3 cr)

Application of quantitative analysis techniques to an engineering education research project. Specific focus on data collection, instrument development, and ANOVA / Regression analysis techniques. EGR 673 is a co-requisite for EGR 572

**APPENDIX I
OPERATIONAL INFORMATION FOR GRADUATE PROGRAMS**

(This information is used to populate the [Graduate Programs Search](#)/catalog website.)

1. Provide a brief (catalog type - no more than 150 words) **program description.**

Engineering Education Systems and Design (EESD) is a transdisciplinary PhD program aimed at advancing understanding of the engineering education ecosystem. The goal of EESD is to enable long-lasting improvement of the learning process and infrastructure in engineering education at all levels by emphasizing the study of education as a complex ecosystem that takes into account the multiple inputs, outputs, and interactions within an educational setting. A typical student will enter the program with a masters degree in an engineering or related discipline; will complete six 3-credit core courses; and select from areas of specialization such as education system design; educational policy and implications; learner analytics; design of online educational environments; or assessment of impact of educational innovations.

Breakdown of requirements for the academic catalog:

Core (18)
Electives (12)
Research (12)
Previously awarded master's degree (30)*
Culminating Experience: EGR 799 Dissertation (12)
Total credit hours required for the program: 84

*If students do not have a master's degree, the remaining 30 hours will be made of elective and research which will satisfy degree requirements for a Masters in engineering or related field.

2. Campus(es) where program will be offered:

(Please note that Office of the Provost approval is needed for ASU Online campus options.)

ASU Online only (all courses online)

All other campus options (please select all that apply):

Downtown Polytechnic
 Tempe West

Both on-campus **and** ASU Online (*) - (Check applicable campus from options listed.)

(*) Please note: Once students elect a campus option, students will not be able to move back and forth between the on-campus (in-person) or hybrid options and the ASU Online campus option.

3. Admission Requirements:

Degree: Minimum of a bachelor's or master's degree in engineering, or a closely related field from a regionally accredited College or University. Master's degree in engineering or related field from a regionally accredited College or University.

GPA: Minimum of a 3.00 cumulative GPA (scale is 4.0=A) in the last 60 hours of a student's first bachelor's degree program. Minimum of 3.25 cumulative GPA (scale is 4.0 = A) in the applicable Master's degree.

English Proficiency Requirement for International Applicants: The English proficiency requirements are the same as the Graduate Education requirement. (see Graduate Education requirement http://graduate.asu.edu/admissions/international/english_proficiency): **Yes** **No**

Foreign Language Exam:Foreign Language Examination(s) required? Yes No**Required Admission Examinations:** GRE GMAT Millers Analogies None required**Letters of Recommendation:** Yes No

4. **Application Review Terms (if applicable Session):** Indicate all terms for which applications for Admissions are accepted and the corresponding application deadline dates, if any:

 Fall (regular)*Deadline:* Fall 2016*International Applicants:* For admission in the fall semester you must apply by January 1st of the same year*Domestic Applicants:* For admission in the fall semester you must apply by March 1st of the same year Spring (regular)*Deadline:* Spring 2016*International Applicants:* For admission in the fall semester you must apply by August 1st of the preceding year*Domestic Applicants:* For admission in the fall semester you must apply by October 1st of the preceding year

5. **Curricular Requirements:**

(Please expand tables as needed. Right click in white space of last cell. Select "Insert Rows Below")

5A. **Will concentrations be established under this degree program?** Yes No

5B. **Curricular Structure:**

Required Core Courses for the Degree			Credit Hours
(Prefix & Number)	(Course Title)	(New Course?) Yes or No?	(Insert Section Sub-total) 18
EGR 565	Qualitative Methods for Engineering Education Research	Yes	3
EGR 671	Applications of Qualitative Methods for Engineering Education Research	Yes	3
EGR 572	Quantitative Methods for Engineering Education Research	Yes	3
EGR 673	Applications of Quantitative Methods for Engineering Education Research	Yes	3
EGR 574	Engineering Education Systems in Context	Yes	3
EGR 535	Engineering Innovation and Entrepreneurship	No	3
Electives Courses (As deemed necessary by supervisory committee. Students choose 4 courses for a total of 12 credit hours.)			Credit Hours

(Prefix & Number)	(Course Title)	(New Course?) Yes or No?	(Insert Section Sub-total) 12
EGR 598	Mixed Methods for Engineering Education Research	Yes	3
EGR 502	Principles of Independent Research	Yes	3
EGR 520	Engineering Systems Design and Analysis	No	3
EGR 530	Principles of Systems Engineering	No	3
EPA 565	Critical Topics in Education Policy	No	3
EDP 504	Learning and Instruction	No	3
EDP 540	Theoretical Views of Learning	No	3
EDP 554	Analysis-of-Variance Methods	No	3
EDT 501	Foundations and Issues in Educational Technology	No	3
EDT 506	Educational Evaluation	No	3
EDT 523	Distance Education Theory and Practice	No	3
<u>Culminating Experience</u> <i>E.g. - Capstone course, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable</i>			<u>Credit Hours</u> (Insert Section Sub-total) 12
EGR 799 Dissertation			12
<u>Other Requirements</u> <i>E.g. - Internships, clinical requirements, field studies as applicable</i>			<u>Credit Hours</u> (Insert Section Sub-total)
EGR 792 Research			12
<p>For doctoral programs – when approved by the student's supervisory committee, will this program allow 30 credit hours from a previously awarded master's degree to be used for this program? If applicable, please indicate the 30 credit hour allowance that will be used for this degree program.</p> <p>If students do not have a master's degree, the remaining 30 hours will be made of elective and research related to a relevant Master's degree program offered by the Fulton Schools. As an example, The Polytechnic School offers a Master's in Engineering and an example of required and elective courses is given in the table below.</p>			30
Total required credit hours			84

- List all required core courses and total credit hours for the core (required courses other than internships, thesis, dissertation, capstone course, etc.).
- Omnibus numbered courses cannot be used as core courses.
- Permanent numbers must be requested by submitting a course proposal to Curriculum ChangeMaker for approval. Courses that are new, but do not yet have a new number can be designated with the prefix, level of the course and X's (e.g. ENG 5XX or ENG 6XX).

Master's in Engineering, Example of Required and Elective Courses to meet 30 credit hours		Credit hours
EGR520	Engineering System Design and Analysis	3
EGR530	Principles of Systems Engineering	3

EGR525	Lean Systems	3
EGR598	Simulation	3
ALT 505	Power Conditioning	3
ALT 512	Village Energy Systems	3
EGR 570	Capstone Design	3
EGR 598	Special Topics	9

6. Comprehensive Exams:

Doctoral Comprehensive Exam (required), please select the appropriate box.

(Written comprehensive exam is required)

- Oral comprehensive exam is required – in addition to written exam
- No oral comprehensive exam required - only written exam is required

7. For Doctoral Degrees that require a dissertation, submission of a written dissertation prospectus and its oral defense are required. (Please include any required timelines for defense of the prospectus.) It is expected that the submission of a written dissertation prospectus and its oral defense will take place no later than the end of the fourth year.

Students will be expected to submit a dissertation prospectus/proposal and hold the oral defense by no later than the end of the third year.

8. Allow 400-level courses: Yes No (No more than 6-credit hours of 400-level coursework can be included on a graduate student plan of study.)

9. Committee: Required Number of Thesis or Dissertation Committee Members (must be at least 3 including chair or co-chairs):

3 members, committee must include at least one Polytechnic School faculty member

10. Keywords (List all keywords that could be used to search for this program. Keywords should be specific to the proposed program.)

Engineering education, design education, educational innovations, curriculum design, educational ecosystem, engineering assessment, engineering education policy

11. Area(s) of Interest

A. Select one (1) primary area of interest from the list below that applies to this program.

- | | |
|--|---|
| <input type="checkbox"/> Architecture & Construction | <input type="checkbox"/> Interdisciplinary Studies |
| <input type="checkbox"/> Arts | <input type="checkbox"/> Law & Justice |
| <input type="checkbox"/> Business | <input type="checkbox"/> Mathematics |
| <input type="checkbox"/> Communication & Media | <input type="checkbox"/> Psychology |
| <input type="checkbox"/> Education & Teaching | <input type="checkbox"/> STEM |
| <input checked="" type="checkbox"/> Engineering & Technology | <input type="checkbox"/> Science |
| <input type="checkbox"/> Entrepreneurship | <input type="checkbox"/> Social and Behavioral Sciences |
| <input type="checkbox"/> Health & Wellness | <input type="checkbox"/> Sustainability |
| <input type="checkbox"/> Humanities | |

B. Select one (1) secondary area of interest from the list below that applies to this program.

- | | |
|--|--|
| <input type="checkbox"/> Architecture & Construction | <input type="checkbox"/> Interdisciplinary Studies |
| <input type="checkbox"/> Arts | <input type="checkbox"/> Law & Justice |
| <input type="checkbox"/> Business | <input type="checkbox"/> Mathematics |
| <input type="checkbox"/> Communications & Media | <input type="checkbox"/> Psychology |

- [Education & Teaching](#)
- [Engineering & Technology](#)
- [Entrepreneurship](#)
- [Health & Wellness](#)
- [Humanities](#)

- [STEM](#)
- [Science](#)
- [Social and Behavioral Sciences](#)
- [Sustainability](#)

12. Contact and Support Information:

Office Location (Building & Room):	Sutton Hall, 140J
Campus Telephone Number:	7-5121
Program email address:	egr@asu.edu
Program website address:	http://innovation.asu.edu/degrees-programs
Program Director (Name):	Ann McKenna
Program Support Staff (Name):	Amy Wolsey, Grant Griffin
Admissions Contact (Name):	Amy Wolsey

13. Application and iPOS Recommendations: List the Faculty and Staff who will input admission/POS recommendations to Gportal **and** indicate their approval for Admissions and/or POS:

Name	ADMSN	POS
Amy Wolsey	yes	yes
Grant Griffin	yes	yes
Brad Rogers	yes	yes

APPENDIX II
SUPPORT STATEMENTS

Ira A. Fulton Schools of Engineering - Official Submission

From: Jeremy Helm
Sent: Thursday, March 12, 2015 2:08 PM
To: Curriculum Planning
Cc: James Collofello; Ann McKenna; Bradley Rogers; Cindy Boglin
Subject: PhD in Engineering Education Systems and Design

Hello,

Please find attached:

- Proposal for the PhD in Engineering Education Systems and Design (Signed PDF)
- Proposal for the PhD in Engineering Education Systems and Design (Word Document)
- A letter of support from Teachers College

Jeremy Helm
Director, Academic Administration & Student Success
Ira A. Fulton Schools of Engineering
Arizona State University
Tempe, AZ 85287-8109
(480) 965-8931 voice
(480) 965-8095 fax

Mary Lou Fulton Teachers College – Support Statement



TO: James S. Collofello, Senior Associate Dean of Academic and Student Affairs

FROM: Hilary Pierce, Senior Assistant Dean of Academics

DATE: February 19, 2015

SUBJECT: Proposed PhD in Engineering Education Systems and Design
Ira A. Fulton Schools of Engineering

This is to serve as a letter in support of the proposed PhD in Engineering Education Systems and Design to be offered by Ira A. Fulton Schools of Engineering.

This program will support STEM education in both K-12 and higher education through further study of the impact of engineering education programs including the evaluation of how people learn through varied contexts.

The proposed degree does not conflict with any of our programs and we look forward to collaborating with Ira A. Fulton Schools of Engineering on some of the courses.

The courses we already have on the major map are:

- EPA 565 - Critical Topics in Education Policy
- EDP 504 - Learning and Instruction
- EDP 540 – Theoretical Views of Learning
- EDP 554 – Analysis of Variance Methods
- EDT 501 – Foundations and Issues in Educational Technology
- EDT 506 – Educational Evaluation
- EDT 523 – Distance Education Theory and Practice

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