TO: Randy Smith, Vice Provost for Academic Programs
FROM: Jennifer Schlueter, Faculty Fellow for Curriculum, Graduate School
DATE: 24 October 2017
RE: Proposal for a new PhD in Engineering Education

The College of Engineering is proposing a new PhD in Engineering Education, which will build upon the Department of Engineering Education's work in engineering education research, emphasizing teaching as a way of knowing. Support has been obtained from the College of Education and Human Ecology's Department of Teaching and Learning.

The proposal was received by the Graduate School in June 2017. It was reviewed by the combined GS/CAA Curriculum subcommittee, chaired by Interim Dean Herness, on 1 June 2017, and revisions were requested on 9 June 2017. Revisions were received in September 2017, and the proposal received its second review by the combined GS/CAA Curriculum subcommittee, now chaired by the Faculty Fellow, on 6 October 2017. Small revisions were requested. These revisions were received on 13 October 2017. The Faculty Fellow forwarded it on to the Graduate Council for their review on 13 October 2017. The proposal was reviewed and approved at the Graduate Council on 23 October 2017. The positive results of this review were shared with the proposers on 24 October 2017.

From:	Christy, Ann
To:	Schlueter, Jennifer
Cc:	Herness, Scott; Toft, Jill A.
Subject:	Re: GS/CAA curriculum subcommittee review of revised proposal for PhD in Engineering Education
Date:	Friday, October 13, 2017 1:48:17 PM

Greetings:

Thank you for sharing the good news. After polling our Engineering Education graduate studies committee members, I have constructed our response to the two questions raised by the GS/CAA subcommittee:

1.) "We see on page 3 line 14 that 30 credit hours beyond the BA may be transferred into this program. This would mean that an OSU student currently enrolled in a traditional engineering program might be able to shift career paths by applying for admission and, if accepted, transferring in 30 completed hours. One reviewer wondered if there is planned or current potential for a transfer to the PhD for pre/post candidacy graduate students in traditional engineering departments?"

Yes, assuming that their 30 credits align with the courses in our program. Most likely they will not have taken education courses so they would only be transferring in technical disciplinary engineering courses and maybe research methods courses. However, it is possible for someone to do this.

2.) "We see in Appendix 2c the route through the degree for a student who does not hold the M.S. Is there a planned or current potential for a student in this PhD program who clears the candidacy exam to qualify for the M.S.?"

Not at this time, since we don't have a master's program. However, we'd like to have one eventually, and will include this information in any masters program proposal that we submit in the future. We are currently planning to work on a master curriculum design institute under UCAT guidance next summer (Su 2018).

I hope this message answers your concerns, and I assume the proposal itself does not need to be revised at this time. However, please let me know if you would prefer some additional language added to the proposal.

Best regards,
Ann

Ann D. Christy, Ph.D., P.E.

Assistant Dean for Teaching and Learning, College of Engineering
Professor, Department of Engineering Education
Professor, Department of Food, Agricultural, and Biological Engineering

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From: "Schlueter, Jennifer" <schlueter.10@osu.edu>
Date: Friday, October 6, 2017 at 4:02 PM
To: "Ann D. Christy" <christy.14@osu.edu>
Cc: "Herness, Scott" <herness.1@osu.edu>, "Toft, Jill A." <toft.20@osu.edu>
Subject: GS/CAA curriculum subcommittee review of revised proposal for PhD in Engineering Education

> Dear Professor Christy:
>
> At its October 6 meeting, the combined GS/CAA curriculum subcommittee (which I chair as Faculty Fellow) reviewed your revised proposal for a new PhD in Engineering Education. The subcommittee was quite satisfied with your responses to the queries made over the summer and remains extremely enthusiastic about this new program.
>
> Some questions arose about consideration that has been given to alternative routes through this new degree. They include:
>
> - We see on page 3 line 14 that 30 credit hours beyond the BA may be transferred into this program. This would mean that an OSU student currently enrolled in a traditional engineering program might be able to shift career paths by applying for admission and, if accepted, transferring in 30 completed hours. One reviewer wondered if there is planned or current potential for a transfer to the PhD for pre/post candidacy graduate students in traditional engineering departments?
> - We see in Appendix 2c the route through the degree for a student who does not hold the M.S. Is there a planned or current potential for a student in this PhD program who clears the candidacy exam to qualify for the M.S.?
>
> Upon receipt of your answers to these questions, we will be delighted to forward this proposal on to the Graduate Council for their review and approval and, subsequently, to CAA for theirs. I'll keep you posted as it moves along.
>
> Best,
> Jen
>
> **Jennifer Schlueter, PhD**
> Associate Chair, Department of Theatre
> Associate Professor | Lab Series Coordinator | Editor, Theatre/Practice
> Faculty Fellow, Curriculum, Graduate School

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September 5, 2017

Dr. Scott Herness
Interim Vice Provost for Graduate Studies
Interim Dean of the Graduate School
The Ohio State University
250 University Hall
230 North Oval Mall
Columbus, OH 43210

RE: Response to Review of Proposal to Establish a PhD in Engineering Education

Greetings Dr. Herness:

Thank you for your detailed review of our proposal to establish a PhD in Engineering Education at the Ohio State University. Attached is our revised proposal which addresses each of the requests for clarifications and other suggestions made by the Graduate School / Council on Academic Affairs curriculum subcommittee as communicated in your letter dated June 9, 2017. Below is an itemized list of those changes and where in the revised document the changes can be found.

1. **Nature of scholarship and types of dissertation topics**: The nature of scholarship in the field of engineering education is described in more detail on pages 2 (lines 24-40) and 10 (lines 8-20). The proposed degree is a research doctorate, and this has been more explicitly stated on pages 1 (line 9) and 3 (line 14). Types of dissertation topics are described, citing current research being pursued by OSU faculty in the department (page 7, line 37 to page 8, line 12) and ten years of dissertation titles from benchmark engineering education graduate programs at Purdue University and Virginia Tech (page 8, lines 14 - 22 and Appendix 2e, pages 1-3), the two oldest and most respected engineering education programs in the U.S.
2. **Faculty Numbers:** The section describing faulty numbers, "P" status, and collaboration with the College of Education and Human Ecology has been expanded (page 18, line 23 to page 19, line 2), as has the section describing the College of Engineering's commitment to hiring tenure track faculty in the near future (page 22, lines 5-10).
3. **Advising**: Students would be advised through the elective portion of the program, leading to an individualized experience. A student advising sheet has been developed which is described on page 7 (lines 1-8) and presented in its entirety in Appendix 2d.
4. **Research Methods coursework**: Nine credits of research methods under three categories (qualitative, quantitative, and advanced/ mixed) are required, but the courses that any given student could use to meet this requirement can and will vary. The revised proposal lists several example existing courses under each of the three categories on page 4 (line

26) through page 5 (line 11). It is not anticipated that the numbers of new students taking any one of these courses will be small, and should not exceed course enrollment limits. Faculty from several of the course offering departments have said that they welcome additional student numbers in their classrooms. Any additional courses proposed by the Department of Engineering Education to meet this requirement will, of course, seek concurrences from the appropriate colleges / departments, but none are proposed at this time.

5. **Qualifying exam**: Details about the qualifying exam are presented on page 6 (lines 31-40). The qualifying exam will be completed by students once they complete these three of the required core engineering education courses: ENGREDU 6100, 6200, and 7780. Qualifying exams will be administered twice a year, once in January and once in August. Students will have two weeks to answer and submit an electronic response to three questions, one based on each course. The graduate committee will be responsible for developing and assessing the responses. Students may receive a high pass, pass, or fail for each response. Students will have two attempts to receive at least a pass on each question. Students only have to retake questions they fail in their first attempt. If after their second attempt, a student does not received at least a pass on all three questions, they will be dismissed from the program.
6. **Traditional Disciplinary Engineering coursework**: A more detailed description of the engineering coursework requirement is presented on page 6 (lines 6-25), including more information about the national professional licensing exam that can be used to show equivalence of an accredited undergraduate engineering degree. In the United States, engineers are licensed at the state level by professional licensing boards. Professional Engineering (P.E.) licensure candidates must meet a combination of requirements in education, experience, and exams. The first of the two major national exams, usually taken within six months of graduation from an accredited undergraduate program, is the Fundamentals of Engineering (FE) examination (NCEES, 2017). A few states will allow candidates with undergraduate degrees in non-engineering STEM fields to sit for these exams, if they can demonstrate appropriate on-the-job engineering experience.
7. **Student Funding**: More details about student funding are presented on page 15 (lines 5-8), page 16 (lines 7-22), and page 22 (lines 12-25). Graduate students will be supported by a combination of university and college fellowships, research grants, teaching assistantships, new faculty start-up allocations, and other departmental funding. The department's large teaching commitment, serving more than 3500 undergraduates annually, means that there is an assured pool of more than twenty graduate teaching assistantships (GTAs) available each year, although not all of these GTA positions will always be filled by engineering education doctoral students.
8. **Specializations**: This doctoral program is not proposing to create formal transcriptable specializations. All students are required to complete twelve hours of specialized coursework, but there is no expectation that any specializations will appear on the student transcript unless the student specifically chooses to draw upon existing OSU programs that are already noted on transcripts. This is described on pages 5 (line 13) through 6. (line 2).
9. **Masters degree**: One or more Masters' degrees will be developed over the next few years, but details have yet to be developed and thus cannot be included in this doctoral

proposal. A full Curriculum Development Institute, led by the University Center for the Advancement of Teaching, is planned for the summer of 2018 to work on engineering education masters programs.

10. **Administration**: More details about how the graduate program will be administered are described on pages 8 (line 28) through page 9 (line 9). The proposed doctoral program will be administered by the department's Graduate Studies Committee whose members include faculty and staff representing different areas within the department. It includes at least three faculty members with level-P status, the graduate program coordinator, and one graduate student representative. The chair of the Graduate Studies Committee is appointed by the department chair for a three-year term and also serves as a member of the College's Graduate Program Chairs Committee. The Graduate Studies Committee's responsibilities include all graduate curriculum matters related to the graduate courses offered by the department. The Committee will recruit and select prospective graduate students, recommend the award of fellowships and graduate teaching and research assistantships to incoming students, ensure that the graduate curriculum and the program graduate study rules are kept current, administer an annual review process for graduate students in the program, review course assessment reports from program directors, administer the graduate examinations required by the program and the Graduate School, and carry out any other charges related to graduate studies that may be requested by the department chair.
11. **Formatting**: The proposal has been reformatted to align with the required format for the eventual review by the Ohio Department of Higher Education.

Again, thank you for your thorough review and suggestions for improvement.

Sincerely,

Ann D. Christy, Ph.D., P.E.

Professor and Chair of the Graduate Studies Committee, Dept. of Engineering Education
Professor, Department of Food, Agricultural, and Biological Engineering
Assistant Dean of Teaching and Learning, College of Engineering

From: Herness, Scott
To: Christy, Ann
Cc: Toft, Jill A.; Herness, Scott
Subject: RE: GS?CAA Curriculum subcommittee PhD Eng Ed
Date: Wednesday, June 14, 2017 10:38:23 AM
Attachments: image002.png

Ann,

Thanks for reaching out.

The proposal should be in the format initially described in the PDP section of the GUIDELINES: the ten section headers that are found on page 6. This will be true for both the PDP and the Full Proposal. Only the PDP has a page limitation. All that we do at the University level and the Full Proposal have no page limitations.

My earlier suggestion to you was to initially develop the proposal using these ten section headers so that you would not have to re-do it when preparing for ODHE submission. I understand that the GUIDELINES aren't crystal clear; that was supposed to be my job! It is easiest to develop the proposal (putting everything in it with no page limitation) in the required format; then you only task is to whittle it down to five pages for the single PDP step. The Full Proposal would then be ready for editing once PDP comments are received.

You can continue in the present format now, should you like. OR, you could do the inevitable re-formatting now. It doesn't matter; I just wanted to bring this to your attention since we will have to address it in the near future.

More questions? Just reach out.

Best,

Scott

THE OHIO STATE UNIVERSITY

Scott Herness
Interim Vice Provost for Graduate Studies
Interim Dean of the Graduate School
Graduate School
250 University Hall, 230 North Oval Mall Columbus, OH 43210-1366
614-247-7413 Office / 614-292-3656 Fax
herness.1@osu.edu

From: Christy, Ann
Sent: Tuesday, June 13, 2017 2:59 PM
To: Herness, Scott <herness.1@osu.edu>
Subject: Re: GS?CAA Curriculum subcommittee PhD Eng Ed

From: Herness, Scott
To: Christy, Ann
Cc: Toft, Jill A.; Herness, Scott
Subject: GS?CAA Curriculum subcommittee PhD Eng Ed
Date: Saturday, June 10, 2017 11:03:04 AM
Attachments: image002.png

June 9, 2017

Ann Christy
Professor
Dept. Engineering Education
College of Engineering

PhD in Engineering Education

The combined Graduate School/Council on Academic Affairs curriculum subcommittee met on June 1st and, among its agenda items, considered the proposal to create a new PhD degree in Engineering Education. The degree, an 80 credit hour dissertation based doctorate, would be housed in the newly formed Department of Engineering Education in the College of Engineering. The subcommittee found the curriculum and assessment of the core courses to be exceptionally well developed and clearly narrated. However, they request clarification on a number of other points. These comments are provided in effort to strengthen the proposal prior to its subsequent review process including the required statewide review though the Ohio Department of Higher Education.

- A major question that arose concerned the nature of the scholarship students would pursue in completing their dissertation. At present, committee members questioned whether the intent is to produce a professional or a research doctorate, i.e. graduates who practice the profession (such as the Ed.D) or who contribute to the scholarship of the profession through original research (the PhD). The latter is assumed. The proposal details its core curriculum well yet the subsequent thirty research hours are not described. Elective courses may provide a preview into the types of expected dissertation topics, but descriptions are not extant. Examples of varying dissertation topics, the nature of the research projects, and integration into elective themes would be very helpful.

- Another significant concern regards the number of faculty who would be eligible to participate in the graduate program. To serve as a doctoral advisor, faculty will require "P" status from the Graduate School. At present, only five of the listed faculty would be eligible for "P" status. As a newly formed department, five additional faculty are promised. Is this a firm commitment and will these be P-eligible (i.e., tenure-track) hires? Also, will faculty from the College of Education and Human Ecology participate in the doctoral program? A better more explicit description of number of faculty

eligible to serve as advisors (P-status) and the projected enrollment (at one point up as high as 50 students per year) is required.

- A question arose as to how a student would he advised through the elective portion of the curriculum. It is assumed that these electives parallel the dissertation topic (as previously mentioned). Will there be a student advising sheet (look to CEHE for some excellent examples of doctoral student advising sheets)?

- Nine credits in research methods are required; however, no courses are listed. Please provide more detail for this portion of the curriculum. If these are pre-existing courses in other colleges/departments, then concurrences will be needed.

- Appendix 2C presents a qualifying exam at the end of the first year which is not mentioned in the proposal. Details of the proposal would be appreciated. For example, what material is covered in the exam? Who gives/grades the exam? What are the alternatives/consequences for the student who fails?

- Twelve credit hours in traditional engineering coursework at 5000 level or higher are required. The caveat is presented that some students (e.g., those with non-engineering STEM background) may need to enroll in engineering course work below the 5000 level. It is important to note that not all of this course work can count towards the PhD and this constraint should be transparent to the student. Further, a description of how students may test-out through *Fundamentals of Engineering (FE) Exam* (with which most committee members are unfamiliar) would be helpful.

- How students will be funded in the program could be more explicitly described. GA lines are mentioned in the proposal (21 GTAs on pg. 1; 32 GTAs on pg. 17) though it is uncertain if these lines will partially or completely be available to support students in this graduate program. Any detail on committed fiscal support for the program from the department or college would strengthen the proposal.

- Will the doctoral program create formal transcriptable specializations in the future?

- A Master's degree has been mentioned as a long-term goal. How would an embedded Master's degree be integrated into the doctoral program? In the future, would the program wish to admit to a Master's degree before progression to the doctorate or create an embedded Master's degree for post-candidacy students unable to adequately progress to the PhD? Either of these scenarios might best be considered within this proposal, rather than at a later date.

- There is no mention of the graduate program will be administered. How will the graduate studies committee be formed? How will the Graduate Studies Chair chosen? Will the students have annual reviews by the committee?

Finally, I note for information purposes that the proposal is not in the required format for the eventual review by the Ohio Department of Higher Education (though an earlier draft was). I have, on previous occasions, shared this format with you. I mention this merely to inform you that, after Senate approval, the proposal will require re-formatting prior to statewide review.

Please consider the subcommittee's comments and submit a revised proposal with detailed responses to their concerns. As always, I am available for any questions or clarifications.

Following the successful review by the subcommittee, I will submit the proposal to the Graduate Council for their review followed by the Committee on Academic Affairs. The proposal will continue through the university approval process to the University Senate and the Board of Trustees. Additionally, following approval by the University Senate, I will submit the proposal to the Ohio Dept. of Higher Education (formerly the Ohio Board of Regents) for the required statewide review process.

Many thanks,

THE OHIO STATE UNIVERSITY

Scott Herness
Interim Vice Provost for Graduate Studies
Interim Dean of the Graduate School
Graduate School
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614-247-7413 Office / 614-292-3656 Fax
herness.1@osu.edu

Greetings Scott:

Thank you for sharing these comments and suggestions for improving our proposal to establish a PhD in engineering education. My team is working on revisions of individual sections right now, but I wanted to ask you about the formatting comment before we send you our revised proposal. We used the 2015 CCGS guidelines for a full proposal (FP) as our formatting outline (pages 10- 12 of attached CCGS pdf file). Is there a newer set of formatting guidelines that we should follow? Or should we follow the guidelines for the PDP (page 8)?, however in that case, our document will be much longer than the 5 pages required for a PDP. Your advice will be much appreciated.

Best regards,
Ann

Ann D. Christy, Ph.D., P.E.

Assistant Dean for Teaching and Learning, College of Engineering
Professor, Department of Engineering Education
Professor, Department of Food, Agricultural, and Biological Engineering
221 Hitchcock Hall (office)
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christy.14@osu.edu

From: "Herness, Scott" <herness.1@osu.edu>
Date: Saturday, June 10, 2017 at 11:03 AM
To: "Ann D. Christy" <christy.14@osu.edu>
Cc: "Toft, Jill A." <toft.20@osu.edu>, "Herness, Scott" <herness.1@osu.edu>
Subject: GS?CAA Curriculum subcommittee PhD Eng Ed

> June 9, 2017
>
> Ann Christy
> Professor
> Dept. Engineering Education
> College of Engineering
>
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>
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Many thanks,

Scott Hennes

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Department of Engineering Education

Proposal for the establishment of a doctoral graduate program

Ph.D. in Engineering Education

Sept. 5, 2017

Contact:
Ann D. Christy, Ph.D., P.E.

Graduate Studies Committee Chair
Professor of Engineering Education
Professor of Food, Agricultural, and Biological Engineering

christy.14@osu.edu

Proposal writing team:
Ann D. Christy, Monica F. Cox, David A. Delaine, Richard J. Freuler, Deborah M. Grzybowski, Kathleen A. Harper, Jennifer L. Herman, Teresa A. Johnson, Rachel L. Kajfez, Alan L. Kalish, Krista M. Kecskemety, Sheryl A. Sorby, and Peter F. Rogers

THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

eed.osu.edu

Proposal for Ph.D. Engineering Education, OSU College of Engineering

Table of Contents

Proposal for Ph.D. Engineering Education, College of Engineering

1. ***Designation of the new degree program, rationale for that designation, definition of the focus of the program, and a brief description of its disciplinary purpose and significance***

   a. **Designation.** The Department of Engineering Education within the College of Engineering proposes to establish a Ph.D. in Engineering Education as its terminal degree. The proposed degree program is an entry-level, interdisciplinary research program that combines both disciplines of engineering and education.

   b. **Rationale.** The Department of Engineering Education (EED) has emerged from the former Engineering Education Innovation Center after more than 15 years of effort developing and delivering college-wide undergraduate programs originating from a $13M 1992-2003 NSF Coalition Grant. The EED was formed to expand The Ohio State University's (OSU's) well-regarded work in engineering education research, building upon already strong scholarship of teaching and learning within our classrooms. The formation of the department in 2015 allowed us to hire tenure-track faculty to further build an engineering education research endeavor. It is this research platform that will develop and support graduate students in our proposed Ph.D. program.

   c. **Definition of focus.** The overall goals for this proposed Ph.D. program are that the successful engineering education doctoral graduate will be able to:

      - Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs,
      - Design, conduct, and critique research in engineering education,
      - Demonstrate, value, and apply engineering expertise,
      - Create, teach, and assess courses and curricula in engineering, and
      - Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits.

   d. **Description of disciplinary purpose.** To meet current and future global needs, OSU is committed to achieving eminence in both research and teaching. Within the College of Engineering, reaching this eminence goal relies upon attracting and retaining a diverse, highly talented pool of engineering educators and researchers; on developing and delivering evidence-based, significant learning experiences to undergraduate and graduate engineering students; recruiting and graduating high quality graduate students, disseminating our work to others in the engineering and engineering education communities; and on launching new professionals in

possession of strong disciplinary knowledge in engineering and similarly strong multidisciplinary general education.

e. <u>Description of significance</u>. The following section is organized to specifically address four of the evaluation criteria listed in the Ohio Department of Higher Education's Chancellor's Council on Graduate Studies (CCGS) Guidelines and Procedures for Review and Approval of Graduate Degree Programs (2015, p.8). The bolded subheadings below are derived directly from that document. Other CCGS criteria are specifically addressed in Sections 2, 3, and 8 of this proposal.

i. Description of program differences (conceptual and qualitative) from undergraduate engineering education (or related) programs. The program is distinctly different, both conceptually and qualitatively, from the one undergraduate degree program at Ohio Northern University (ONU) in the same discipline due to its focus on research and the application of engineering education theories to a wider breadth of learning settings including higher education, K-12, industry, nonprofits, and government. The program at ONU is unique being the only undergraduate degree in engineering education in the country. Our proposed program is similar to other engineering education graduate programs in that many of the formal programs house first-year engineering curricula and confer graduate degrees in engineering education-related areas. The proposed program is different from those graduate programs in its emphasis on specializations and career goals beyond higher education.

ii. Program emphasizes the theoretical basis of Engineering Education expressed in methods of inquiry and ways of knowing. As a disciplinary education field, the theoretical basis for engineering education has much in common with other disciplinary based educational research. Foundations include learning theory, cognitive sciences, and organizational change theory (Froyd and Lohmann, 2014). Other researchers suggest that the three conceptual frameworks of behaviorism, cognitivism, and situativity are commonly used for designing rigorous engineering education research investigations (Newstetter and Svinicki, 2014). Methods of inquiry range from the quantitative methods in which most engineering faculty are well trained, to the qualitative and mixed methods more common in social science and educational research literature. Engineering education, as a discipline, bridges all three of these research approaches (Johri and Olds, 2014). The proposed curriculum allows students to explore these theories and methods in core courses (ENGREDU 6100, 6200, and 7780) with an additional nine hours of research methods (quantitative, qualitative, and advanced / mixed methods) which will be taken in departments across the university.

iii. Program emphasizes professional decision making and teaches use of critical analysis in problem solving. The nature of graduate education aligns with such decision making and critical analysis. The proposed engineering education courses will include higher-order thinking and reflective elements including an annual review administered by the graduate studies committee

which will allow students to synthesize content across courses and apply engineering learning mechanisms and approaches to engineering practice.

iv. **Program educates students broadly.** The program is designed to educate students broadly so that they have an understanding of the major issues and concerns in the engineering education discipline or professional area. Several of the program learning outcomes address this specifically. The curricular map in Appendix 2b identifies where and at what level of proficiency (beginning, intermediate, and advanced) in the curriculum students will engage with major issues in the discipline. The twelve credit hours of coursework within an individual specialization also adds to the breadth of the students' education.

2. ***Description of proposed curriculum.***

The proposed degree is a research doctorate which will require a minimum of 80 credits beyond the Bachelor's degree (which may include up to 30 hours of transfer credit beyond the Bachelor's degree) with a program of study approved by the student's advisory committee. The total number of credit hours required is aligned with other Ph.D. programs in OSU's College of Engineering.

This proposed Ph.D. in engineering education requires more coursework (50 credit hours) than dissertation research (30 credit hours). In traditional Ph.D. programs in disciplinary engineering fields (e.g., civil engineering, mechanical engineering), the opposite is usually true. However, our credit hour balance is aligned with other engineering education Ph.D. programs in the U.S. For example, benchmark programs at Purdue University (42 coursework credits and 32 dissertation research credits) and Virginia Tech (48 coursework credits and 30 dissertation research credits) have a similar balance. This difference relative to disciplinary engineering is mainly due to the number of education research focused courses students are required to take in engineering education programs that are not required in traditional Ph.D. programs in engineering. In our program, students will be required to take 12 credits of coursework specifically focused on research methods (three within the department and nine outside of the department).

In conjunction with this proposal to establish a new degree program, the department requests approval of a new Course Catalogue Designation of ENGREDU for all graduate courses offered by the department. As a new degree program in a new department, a new course catalog designation will help distinguish our courses from those of other departments on student transcripts and within the course catalog. This particular name, ENGREDU, is proposed as a good way to avoid confusion with English (abbreviated as ENG in some places), and our own undergraduate general engineering courses (designated ENGR) which serve the entire College of Engineering while still showing the close tie between our unit's undergraduate and graduate course offerings.

Appendix 2 contains curricular details including the program learning outcomes which support the five program goals and descriptions of three specific levels of proficiency (e.g., beginning, intermediate, and advanced, see Appendix 2a) for each learning outcome. This describes what students will be expected to do to demonstrate beginning, intermediate, and advanced levels of proficiency for each outcome. Appendix 2b presents how the levels of

proficiency for each of the program learning outcomes are mapped onto the required courses and other program elements. The department gratefully acknowledges the wisdom, guidance, and facilitation provided by the University Center for the Advancement of Teaching in developing this curriculum, and thanks Drs. Alan L. Kalish and Teresa A. Johnson for working with the proposal writing team as a learning community through all aspects of curriculum design and assessment planning.

A summary of a typical program includes:

- **Seventeen credits of required core engineering education coursework** (Note: syllabi for these core courses are included in Appendix 3):
    - ENGREDU 6100: Foundations and the Field of Engineering Education (three credits)
    - ENGREDU 6200: Learning Theory, Pedagogy, and Assessment (three credits)
    - ENGREDU 7189.01: Engineering Education Practicum I (two credits, must be taken in the same term as the start of a significant two-semester teaching experience)
    - ENGREDU 7189.02: Engineering Education Practicum II (one credit, must be taken in the same term as the second semester of a significant two-semester teaching experience)
    - ENGREDU 7780: Engineering Education Research Methods (three credits)
    - ENGREDU 7881: Seminar in Engineering Education (one credit each semester with a requirement of two total to count toward the degree with expectation that students will participate each semester of enrollment unless there are schedule conflicts)
    - ENGREDU 7900: Professional Development in Engineering Education (three credits)
- **Nine credits in research methods** through courses that support the student's research
    - Three credits of quantitative research methods that includes an emphasis on statistics, including but not limited to the following existing OSU courses:
        - STAT 5510: Statistical Foundations of Survey Research
        - STAT 6410: Design and Analysis of Experiments
        - ESQREM 6641: Introduction to Educational Statistics
        - ESQREM 6661: Introduction to Educational Measurement
        - AEE 8860: Research Design
    - Three credits of qualitative research methods, including but not limited to the following existing OSU courses:
        - ESHESA 7256: Qualitative Research in Higher Educational Settings

- EDUTL 8001: Discourse Analysis and Educational Research I
- EDUTL 8002: Discourse Analysis and Educational Research II
- ESQRE 8280: Qualitative Research in Education: Paradigms, Theories, and Exemplars

  - Three credits of advanced / mixed research methods, including but not limited to the following existing OSU courses:
    - ESQREM 7635: Advanced Research Methods
    - EDUTL 7749 Concept Inventories in STEM Education
    - ESQRE 8290: Qualitative Research in Education: Methods and Analysis
    - EDUTL 8751: Survey and Critical Analysis of Research in STEM Education

- **Twelve credits of specialization elective coursework** through approved courses that support the student's research focus and future career goals to include:
  - Three credits minimum within the Department of Engineering Education
  - Three credits minimum outside the Department of Engineering Education
  - A coherent course of study in the student's chosen area of specialization. Each faculty advisor will work with their students to together define the specialization focus for each student's coursework, based on student needs and faculty interests. Further categorization will be developed among the emergent individual specializations. It is not intended that any specializations will appear on the student transcript unless the student specifically chooses to draw upon existing OSU programs that are already noted on transcripts. Some examples (many of which are transcriptable) include:
    - Adult education / Business human resource development
    - African American and African studies (transcriptable OSU graduate minor)
    - Applied developmental science in education (transcriptable OSU interdisciplinary specialization)
    - College and university teaching (transcriptable OSU interdisciplinary specialization)
    - Disability studies (transcriptable OSU interdisciplinary specialization)
    - Engineering technical communications
    - Humanitarian engineering
    - Inter-professional studies (transcriptable OSU interdisciplinary specialization)
    - Latino/a studies (transcriptable OSU interdisciplinary specialization)
    - Neuroscience (transcriptable OSU graduate minor)
    - Nonprofit studies (transcriptable OSU graduate minor)
    - Public policy and management (transcriptable OSU graduate minor)
    - Sexuality studies (transcriptable OSU interdisciplinary specialization)
    - Statistics and statistical data analysis (transcriptable OSU graduate minor)

- Survey research (transcriptable OSU interdisciplinary specialization)
- Women's, gender, and sexuality studies (transcriptable OSU graduate minor)

- **Twelve credits in traditional engineering coursework** at the 5000 level or higher*
- **Thirty credits of dissertation research** (ENGREDU 8999 or other approved 8999 course)

* *Ph.D. candidates with an undergraduate degree in non-engineering STEM fields (e.g., math, physics or chemistry) are generally required to take two to five undergraduate courses in a selected traditional engineering discipline, including a significant engineering design experience, to adequately prepare them for graduate level courses at the 5000 or higher level. Students must receive approval for these courses from a potential faculty advisor. Not all of this course work can count towards the PhD degree, and this constraint will be made transparent to students who are in this situation.*

Alternatively, students may demonstrate their engineering proficiency, and thus their eligibility to enroll in graduate-level engineering coursework, through successful completion of the Fundamentals of Engineering (FE) examination (NCEES, 2017) and demonstrated completion of a significant engineering design experience. In the United States, engineers are licensed at the state level by professional licensing boards. Professional Engineering (P.E.) licensure candidates must meet a combination of requirements in education, experience, and exams. The first of the two major national exams, usually taken within six months of graduation from an accredited undergraduate program, is the Fundamentals of Engineering (FE) examination (NCEES, 2017). A few states will allow candidates with undergraduate degrees in non-engineering STEM fields to sit for these exams, if they can demonstrate appropriate on-the-job engineering experience.

All students in the Ph.D. in engineering education program will complete three exams: qualifying exam, candidacy exam, and final defense. The qualifying exam will be administered by the graduate committee and is detailed below. The candidacy exam and the final defense will be administered by the advisor and the student's dissertation committee in accordance with graduate school policies.

The qualifying exam will be completed by students once they complete these three of the required core engineering education courses: ENGREDU 6100, 6200, and 7780. Qualifying exams will be administered twice a year, once in January and once in August. Students will have two weeks to answer and submit an electronic response to three questions, one based on each course. The graduate committee will be responsible for developing and assessing the responses. Students may receive a high pass, pass, or fail for each response. Students will have two attempts to receive at least a pass on each question. Students only have to retake questions they fail in their first attempt. If after their second attempt, a student does not received at least a pass on all three questions, they will be dismissed from the program.

Appendix 2c presents a typical course of study on a semester-by-semester basis for an admitted student who already has earned a Bachelor's degree in an engineering discipline

and for one who enters having already earned a Master's degree in an engineering discipline. A student advising sheet (Appendix 2d) will be completed during conversations between the student and faculty advisor to map out an individualized curriculum that serves the student's aspirations and equips them to perform their chosen engineering education dissertation research while meeting all program requirements. The advising sheet serves as an agenda for a student's plan of study while enrolled in the Ph.D. program, listing core requirements, elective courses, research methods and practicum courses, and details about the candidacy exam and dissertation research.

Students with non-STEM undergraduate degrees are advised to take courses equivalent to Ohio State's core undergraduate engineering program before applying for admission to the graduate program. For additional information, students will be directed to consult with the Graduate Studies Chair.

How curriculum develops competence in Engineering Education. The program goals and learning outcomes (Appendix 2a) describe what this department's faculty considers competence in engineering education. The curricular map (Appendix 2b) indicates the levels of proficiency in each of the learning outcomes that students are expected to achieve and where evaluations of proficiency will occur. Assessment of these learning outcomes within course assignments and during students' annual reviews will provide ongoing feedback on students' developing competence in engineering education. Appendix 4 presents the proposed assessment plan as entered in OSU's online institution-wide assessment tracking tool, TracDat.

Plans for professional accreditation including core courses. Professional engineering accreditation (ABET, 2017) is typically tied to the undergraduate degree, not any subsequent graduate degree. However, an external review of courses will be conducted by professionals in the engineering education community via a departmental advisory board.

3. ***Description of required culminating degree, or integrated learning, experience.***
The required culminating experience of this Ph.D. program is a doctoral dissertation in an individual area of engineering education designed by the student and his/her advisor and graduate advisory committee. Students, in collaboration with their advisor and committee, design and complete a research project or series of projects that leads to the writing and successful defense of the dissertation.

Expected topics for dissertation research range from diversity and inclusion in the engineering classroom and professional engineering workforce to pedagogies and assessment methods to improve engineering education in the university environment. Departmental faculty currently are conducting and collaborating on research in the following areas as listed on the webpage <eed.osu.edu>:

- Boundary Spanning with Engineering Education and Community Engagement - Delaine
- Development and Validation of Assessments for Industry-Valued Professional and Technical Learning Outcomes in Engineering Education - Rogers
- Development of Empathy within student participants of Community Engagement - Delaine
- Engineering Education for Students with Visual Impairments (EEVI) Project - Grzybowski
- Engineering is Elementary - Ohio - Kajfez
- Grading Training of Technical Writing Assignments in 1st-Year Engineering - Kecskemety

- Implementing an Open-Ended Game Software Design Project in First-Year Engineering - Kecskemety
- International design projects linking study abroad and capstone courses - Christy
- More than recruitment and outreach: Diversity and inclusion in engineering education curricula and classrooms - Kuzawa
- Professional development for undergraduate engineering students - Christy
- Service learning and real-world client-centered student design projects - Christy
- smART: ART Integrated Formal and Informal STEAM Education - Grzybowski
- Student Perspectives on Researcher Identity and Transformed Epistemologies (SPRITE) - Kajfez
- Writing as knowing: Creative knowing through multiple messaging modes in an engineering technical communications course – Kuzawa

Many of these topics lend themselves well to integration with themes in specialization elective coursework. It is anticipated that this list of research topics will expand as more faculty join the department and current faculty grow their expertise. Another indicator of potential research topics in the field of engineering education is presented in Appendix 2e which lists ten years of dissertation titles from the two largest and oldest engineering education programs in the US: Purdue University's School of Engineering Education and Virginia Tech's Department of Engineering Education. While most of this research has occurred within higher education settings, we anticipate that our graduates will be able to conduct research in nonacademic settings as well.

Procedures for dissertation examination follow the guidelines of the Graduate School where final approval of the dissertation entails formal committee review and approval of a written document and successful completion of a final oral examination. Final approval of the written dissertation is required for graduation.

4. ***Administrative arrangements for the proposed program: department and school or college involved.***

The engineering education Ph.D. program resides within the Department of Engineering Education which is within the College of Engineering at OSU. The proposed doctoral program will be administered by the department's Graduate Studies Committee whose members include faculty and staff representing different areas within the department. The composition of the committee is designed so that areas of the department graduate curriculum offerings are fairly represented. It also includes at least three faculty members with level-P status, the graduate program coordinator, and one graduate student representative. The chair of the Graduate Studies Committee is appointed by the department chair for a three-year term and also serves as a member of the College's Graduate Program Chairs Committee. The appointments of the faculty and staff members on the Graduate Studies Committee are for three years, and individual appointments are staggered. The student representative will be selected from among the engineering education graduate students for a rotating one-year term.

The Graduate Studies Committee's responsibilities include all graduate curriculum matters related to the graduate courses offered by the department. The Committee will recruit and select prospective graduate students, recommend the award of fellowships and graduate teaching and research assistantships to incoming students, ensure that the graduate curriculum and the program graduate study rules are kept current, administer an annual review process for graduate students in the program, review course assessment reports from program directors, administer the graduate examinations required by the program and the Graduate School, and carry out any other charges related to graduate studies that may be requested by the department chair.

5. ***Evidence of the need for the new degree program, including opportunities for employment of graduates. Address other similar programs in the state.***

Institutional support for this new degree program. OSU currently offers over 90 doctoral programs, most recently adding new Ph.D. programs in Italian and Portuguese in 2012. According to the Graduate School Strategic Plan (Osmer, 2010, p.2-3), their main strategies include the following:

- Increase the national and international visibility of the graduate programs at Ohio State
- Enhance Ohio State's visibility and reputation in interdisciplinary research
- Develop a strategic communication plan to convey the importance of graduate education to on-campus, state, and broader audiences

The same strategic plan states "Traditionally, knowledge advanced within disciplines, and the curriculum was organized within discipline-based departments. However, we now see knowledge advancing not only within the core of the various disciplines but increasingly on the interface of disciplines and through new combinations of disciplines. Ohio State not only has an opportunity but also has the responsibility to fully engage in a next phase of knowledge generation, one that is more interdisciplinary and more cross-disciplinary than has previously been undertaken." (Osmer, 2010, p. 7-9). This proposed Ph.D. program in engineering education is an excellent example of an emergent cross-discipline area of study, combining the fields of engineering and education.

Acknowledging the decentralized nature of graduate education, the strategic plan notes that the Graduate School "does not develop new programs of its own accord. The role of the Graduate School is in working with academic departments in providing data, information and support that will be assistive to the departments as they determine how to expand program opportunities." (Osmer, 2010, p.14). Thus there is no university-level plan for overall development of graduate programs, but rather a plan for facilitating and empowering faculty to develop programs in alignment with their own college and departmental goals.

Ohio State College of Engineering's strategic objectives (October 2014) include several that are directly related to this proposal:

- "Build on our strength in experiential learning to establish national leadership in this area

for Ohio State.

- Transform the Engineering Education Innovation Center (EEIC) to a formal administrative unit within the college.
- Partner across the university to bring forward new academic programs, such as… integrated business and engineering that prepare graduates for modern professional practice."

Societal demand including intellectual development, advancement of the discipline, and employment opportunities. The field of engineering education has roots in formal research dating back over 100 years (Borrega and Bernhard, 2011; Froyd et al., 2012). Over the past twenty years, the field has seen accelerated growth (Froyd and Lohmann, 2014). Engineering education, like other discipline-specific education fields (Fensham, 2004; Coppola, 2011), grew out of the subject matter discipline, in this case engineering, not education. Various professional structures have been developed to support the new domain including discipline-specific conceptual and theoretical development, research methodologies, academic recognition, high-status research journals (e.g., the *Journal of Engineering Education*, *Advances in Engineering Education*, *International Journal of Engineering Education*, and the *European Journal of Engineering Education*), professional associations and conferences, prestigious grant programs, seminal publications, and scholarly outcomes applicable to the practice of engineering education.

Five years before the Department of Engineering Education was formed, its predecessor, the Engineering Education Innovation Center, collaborated with the College of Education and Human Ecology to offer a Ph.D. degree in STEM Education with a specialization in Engineering Education. Now a department, the unit continues to develop additional courses to expand the engineering-specific course offerings for the STEM Ph.D. program. The current STEM doctoral program has graduated 15 students including three engineers. One is currently a post-doctoral researcher, one is a tenure-track Assistant Professor at Embry-Riddle Aeronautical University, and the third just accepted a lecturer position at Penn State Behrend. This new proposed Ph.D. program is solely focused on engineering education, providing a distinct but complementary alternative to the existing STEM education program.

Employment opportunities for engineering education graduates are growing. Over the past few years, several academic positions within engineering education have been posted and filled. This trend is increasing as more universities consider engineering education-trained hires within traditional technical engineering departments, joint hires between education and engineering departments, and the development of engineering education institutes, centers, schools, and departments. Within the tech industry, several companies have hired Chief Learning Officers. A Chief Learning Officer is the highest-ranking corporate officer in charge of learning management for employees and clients. Successful candidates for these positions are experts in corporate training and instructional design, with degrees in education, engineering, and/or business. Foundations, non-profits, and informal educational institutions are also hiring professionals with an engineering education background.

Some job postings listed over the 2016-2017 academic year hiring cycle include:

- Arizona State University – The Polytechnic School of the Ira A. Fulton Schools of Engineering – Engineering Education
- University of Cincinnati –Department of Engineering Education
- University of Michigan – College of Engineering – Engineering Education
- North Carolina State University - Leadership in Public Science (Natural or Social Sciences) position
- Florida International University – STEM Transformation Institute
- University of Texas at Austin – STEM Education Program – Engineering Education
- University of Georgia – College of Engineering – Engineering Education
- The College of New Jersey - The Department of Technological Studies in the School of Engineering – Engineering Education
- University of Colorado – Boulder – ATLAS Institute - Creative Technologies and Design
- University of San Diego - Shiley-Marcos School of Engineering – Engineering Education
- Rowan University – Henry M. Rowan College of Engineering – Electrical Engineering

Many sites function as portals pertinent to job opportunities within the field of engineering education:

- PBWorks Engineering Education Job Postings: http://engineeringeducationlist.pbworks.com/w/page/48108151/Engineering%20Education%20Job%20Postings
- The Chronicle of higher Education: https://chroniclevitae.com/job_search/new
- Higher Ed Jobs: https://www.higheredjobs.com/
- EDSurge: https://www.edsurge.com/jobs/

Scope including local, regional, national, and international need. OSU's Department of Engineering Education will contribute to local, regional, national, and international needs through research and practice within the field of engineering education. The grand challenges of the 21st century (NAE, 2008) alongside the emergent needs of the global, knowledge economy (Burton-Jones, 2011) require that engineering education be more closely aligned with societal needs and more agile in its ability to respond to emerging challenges. A "knowledge economy" employs knowledge as the key engine of competitive growth, where knowledge is acquired, created, disseminated, and used effectively to enhance economic development. Knowledge-enabled economies must be able to constantly

modernize their education systems in line with changes in economic realities. These changes must be both systemic and deep, affecting the nature of teaching and learning. As more economies shift towards knowledge-intensive directions, the demand for professional skills and competencies increases significantly.

The nature of these challenges and the continued pace of technological advancement make it imperative that technical knowledge be supplemented with professional skills to develop an "adaptive engineering leader" who is capable of addressing the multiple challenges of an ever-changing world (GEDC, 2010). The field of engineering education and the Department of Engineering Education will respond to these challenges to develop the engineering education professional required by globalized economies.

Engineering education has established a strong position with academic structures within the United States and beyond. Worldwide, there are thirty-three institutions that specifically offer engineering/STEM education graduate programs (ASEE-SD & CELT, 2017), of which eight are international including locations in Canada, Denmark, Malaysia, Mexico, and Sweden. As the field continues to develop, more opportunities to partner and collaborate both with domestic and international institutions will emerge, providing further ability for national and global impact.

A survey (Appendix 4) was developed to gather input from potential and future students to help establish this as a student-centered engineering education doctoral program and curriculum. Results can help inform program formation and continuous quality improvement, as well as focus recruiting efforts.

Programs available in other institutions. Currently in the State of Ohio, there are no other institutions that offer a Ph.D. in Engineering Education. Worldwide, there exists thirty-three institutions that specifically offer engineering/STEM education graduate programs (ASEE-SD & CELT, 2017). Two Ohio institutions appear on this list -- The Ohio State University and University of Cincinnati -- but neither currently has an engineering education doctoral program. We recently learned that the University of Cincinnati is considering proposing a graduate degree in engineering education in the near future. Although not a graduate program, Ohio Northern University has a new B.S. in Engineering Education program which was described earlier in this document that could provide another potential pathway into OSU's proposed Ph.D. program. As of this writing, OSU's Ph.D. in Engineering Education would be the first in the state.

While Ohio does not have a Ph.D. in Engineering Education, both Purdue University and Virginia Tech offer these degrees and are geographically close to OSU. Their programs are growing and are currently attracting Ohio students since we do not offer such a degree in Ohio. Additionally, the University of Michigan has recently received approval to offer a Ph.D. in the field and is accepting applications.

Nationally, the first department of engineering education was established at Purdue University in 2004, and Virginia Tech followed soon thereafter. A recent unpublished study (Cox, 2016) of these two doctoral programs reports that the majority of graduates from both institutions are employed in higher education. From data collected in late 2015, 85%

of all Purdue and 75% of all Virginia Tech engineering education graduates work in higher education environments. Other employment includes industry (four graduates), nonprofit organizations (three graduates), government (three graduates), and K-12 education (one graduate).

Outside of engineering education specifically, there are STEM Ph.D. programs in the state including one in the College of Education and Human Ecology at OSU. However, these degree programs tend to focus on K-12 education in the science and math fields. The program at OSU has that focus. While some engineering education graduates may work and research in the K-12 space, most have interests that extend well beyond that landscape. While many OSU Department of Engineering Education faculty partner with colleagues in the College of Education and Human Ecology (several of whom have been offered courtesy appointments in the new engineering education department), there exists a need to create an independent graduate program focused on much broader areas of engineering education.

Appropriateness of specific locale for the program. As the land grant institution for the State of Ohio, the Ohio State University is well positioned to support this program so that it can impact Columbus and the entire state. Being situated in central Ohio allows us to more easily reach out to the entire state and also allows us to capitalize on the resources offered in the state capital including the presence of the Ohio Department of Higher Education, the Ohio Department of Education, and the State Board of Registration for Professional Engineers and Surveyors.

Additionally, as a large research university with an established College of Engineering, OSU is well situated to support this discipline-specific education program. At OSU, there are 14 undergraduate engineering degree programs and 9 graduate engineering programs. In the 2014-2015 academic year, OSU's College of Engineering graduated 1486 undergraduate students and 641 graduate students (COE, 2016). This proposed engineering education doctoral program would create a strategic complement to the traditional technical engineering work already being completed in the College.

Opportunities for inter-institutional collaboration. Due to the small nature of engineering education as a discipline, there are many opportunities for inter-institutional collaboration across the nation between the various engineering education departments. Currently many of our faculty are collaborating with other institutions and industry partners on research (See CVs in Appendix 1). There are also many opportunities for collaborations with traditional departments in colleges of engineering in Ohio and beyond.

As an example of an inter-intuitional collaboration across the state, OSU established a group called Ohio Research for Engineering Education (OREE). This group met monthly via teleconference to discuss items related to engineering education research. During its last iteration, OSU, Ohio Northern, University of Cincinnati, Youngstown State, and Cleveland State were represented in the group. We believe that OREE will be a place for researchers across the state to come together to develop inter-institutional collaborations on a variety of topics related to engineering education that will help the field and our proposed Ph.D. program.

6. *Prospective enrollment.*

It is expected that the majority of students entering into the proposed Ph.D. program will have a Bachelor's degree in an engineering discipline. Some may enter with a Master's degree in engineering. Having entered the Ph.D. in engineering education program with an engineering skillset already in place, these students will be able to succeed in the program while gaining an in-depth understanding of the educational aspects of engineering education. Additionally, Ph.D. candidates with an undergraduate degree in a science, technology, engineering, and mathematics (STEM) or other non-engineering field are expected to apply to the program. Additional engineering coursework will be required for students entering with non-engineering undergraduate degrees.

An interesting subset of students will be those with an undergraduate degree in engineering education, currently available at only a few institutions, including one located in Ohio (Ohio Northern University). These students will have already experienced engineering education as a field but with a K-12 focus. Ohio Northern's B.S. in engineering education program is accredited under Accreditation Board for Engineering and Technology's (ABET) general engineering criteria (ABET, 2017) and students are licensed to teach high school math.

We plan to attract Ph.D. students to support our growing research programs with the short-term goal of at least three Ph.D. student advisees per tenure-track faculty. These students will be supported fiscally on sponsored research grants and by shifting some of our department's 22 existing graduate teaching assistant (GTA) lines from students pursuing other engineering graduate degrees to engineering education students. There exists growing demand for graduates of doctoral engineering education programs. The job market for engineering education graduates includes universities, colleges, community colleges, and technical colleges (both in tenure-track and clinical faculty appointments), corporate training organizations, and high schools challenged with incorporating STEM initiatives and engineering design into core science standards. Approximately 75 students have obtained formal degrees in engineering education across the United States through 2015. Numerous others have obtained engineering education-related degrees in Colleges such as Engineering, Education, and Public Policy.

a. Potential enrollment. The proposed Ph.D. program plans to attract 10-20 highly talented prospective students each academic year, plus another 20-30 graduate interdisciplinary specialization (i.e., cross-college graduate minor) students. Through identification of undergraduate pipelines in areas such as engineering, sciences, and STEM education as well as working professionals who want to shift their career focus (e.g., industry engineers, high school science teachers), we will create opportunities to engage these students while simultaneously being responsive and timely to all incoming inquiries. Travel and prospective student engagement is also planned at additional events like the Big Ten+ Graduate Engineering Expo held annually at Purdue University.

To meet prospective students where they are and to increase the exposure of the Department of Engineering Education's graduate program and its faculty to a broader audience, messaging will be tailored via increased social media presence (Barnes and Jacobson, 2013). Being proactive through outreach and interaction in

real time can be facilitated by technology (e.g., webinars and teleconferences) which has been proven integral to reaching audiences who might not live in the vicinity of the university (Breihan, 2007). Additionally, online information sessions where frequently asked questions can be asked and answered will be implemented with resulting FAQs posted on the departmental website. Funding is integral to recruitment, and the department is committed to identifying funding early, while continuing communication to the applicants about the status of their applications, the program, and new opportunities for engagement.

b. Ability to maintain the critical mass of students. The Department of Engineering Education is responsible for courses enrolling over 3500 undergraduate engineering students at Ohio State. For 2016-2017, the department hired 22 graduate and 168 undergraduate teaching assistants to support this large teaching program. This provides a rich setting for engaging in engineering education research and the means to fund graduate students who are interested in advancing the field by transforming research into classroom practice. The department is adding tenure-track faculty with an aggressive research agenda that attracts graduate and undergraduate students to assist in funded engineering education research activities. Finally, departmental faculty teach a course on the professional practice of teaching to approximately 20-30 students each year from across the college. All of these current efforts are producing a source of students, many of whom are interested in teaching and engineering education. As a result, we have created a fertile recruiting ground for Ph.D. candidates from our own student numbers, while developing a program that attracts emerging engineering education researchers and practitioners nationally and internationally.

7. ***Special efforts to enroll and retain underrepresented groups in the given discipline.***
The department plans to diversify our source of Ph.D. candidates and, while our research projects may well attract students from diverse backgrounds outside of Ohio State, promotional activities are planned to recruit beyond OSU and internationally. Recruiting is performed by participation at major engineering education events where faculty and staff serve as speakers, moderators, and program directors (e.g., the annual meeting of the American Society for Engineering Education (ASEE)). Direct promotion includes advertisements in major journals and directories, direct mailings, and booths at major conferences. Members of the faculty will draw upon their professional networks to recruit students directly and indirectly online and face-to-face. Faculty members in the related areas of study from other colleges (such as EHE T&L) will also contribute to student recruitment for engineering education as a subset within STEM education. This includes both the national and international level. Finally, the department will host prospective students at an annual reception day at our institution. This recruiting event will include personal contact with faculty and presentations on current research activities and available resources.

Responding to college strategies, the Department of Engineering Education will place significant priority and resources to recruit women and underrepresented minority students to the proposed Ph.D. program. Centralized and coordinated outreach will intentionally

target messaging to welcome these underserved groups (Tsui, 2009). The College of Engineering recruits on behalf of all engineering disciplines by attending graduate school and exhibitor fairs at diversity conferences such as NSBE (National Society for Black Engineers), SHPE (Society for Hispanic Professional Engineers), SWE (Society of Women in Engineering), and AISES (American Indian Science and Engineering Society).

A lack of financial funding to support underrepresented minority students is known to be a major barrier to the recruitment of this population (Quarterman, 2008). To aid in this effort, OSU's College of Engineering currently has several different fellowship opportunities available to underrepresented students across all engineering departments (e.g., College of Engineering Graduate Fellowships, Discovery Scholars Fellowship), plus multiple University-wide fellowships for which our students are also eligible. These are great tools to help recruit talented individuals and are offered in addition to Graduate Teaching Associateships, Graduate Research Associateships and Graduate Administrative Associateships. In addition, the Department of Engineering Education will connect students to national fellowship opportunities such as the Graduate Education for Minority Fellowships.

The Department of Engineering Education is establishing its own strategic approach to enrolling and retaining Ph.D. students and, given the competitive climate for enrolling underrepresented students, will make full-funding offers (stipend, tuition, and fees and 85% health insurance subsidy) to students admitted early in the admission cycle. We will also maintain consistent contact with our admitted students and bring them to campus to meet with us on one or more occasions. As part of our retention efforts, our enrolled students will participate in the College of Engineering's “graduate student survival skills workshop” designed to help students transition to and be successful in graduate school. The workshop is offered a few days prior to the start of their first semester and includes content on what to expect in graduate school and how to be successful, how to communicate with advisors, and how to find resources within the college and on campus. Studies have shown mentoring programs to be particularly successful in supporting the retention and persistence of underrepresented minorities and females (Olson, 1988; Chesler and Chesler, 2002) although all students benefit from this support. Thus, we will provide mentors for our students during the first semester of study and encourage interaction throughout the program.

One of the program's required core courses focuses on career exploration and professional development (ENGREDU 7900). Students have the opportunity to participate in additional professional development workshops and attend professionally-led seminars to expose students to a broad range of potential careers. We will provide students with a mentoring plan and encourage them to complete an Individual Development Plan (IDP). All our students will have the opportunity to travel to conferences to present their research and will be required to teach at least two semesters. The goal is to keep students connected to our program throughout the admission/yield process by building communities to create a sense of belonging and by providing support for their personal and professional career development. Throughout their doctoral studies, each student will participate in an annual

review that will provide them with the opportunity to give and receive feedback that will aid their career planning. It is anticipated that this will benefit all of our graduate students, but it will especially assist in the retention and success of our students from underrepresented populations. At the time of graduation, we will provide students with exit surveys to gauge feedback about their experiences and gather employment data. Beyond graduation, we will continue to engage our graduates and invite them to participate in recruiting and mentoring of future students.

a. **Institution and departmental profiles of total enrollment and graduate student enrollment of underrepresented groups within the discipline**

Ohio State's College of Engineering publishes annual enrollment data. Figure 1 summarizes those data for engineering graduates for the period of 2011-2015 including demographic information. These data are for all engineering graduate students at OSU, not engineering education students. More closely aligned to the proposed program is the Ph.D. degree in STEM Education with a specialization in Engineering Education offered by the OSU College of Education and Human Ecology in collaboration with the Department of Engineering Education. The engineering education specialization was established in 2010 and has produced three graduates so far. Two of the three are from underrepresented populations.

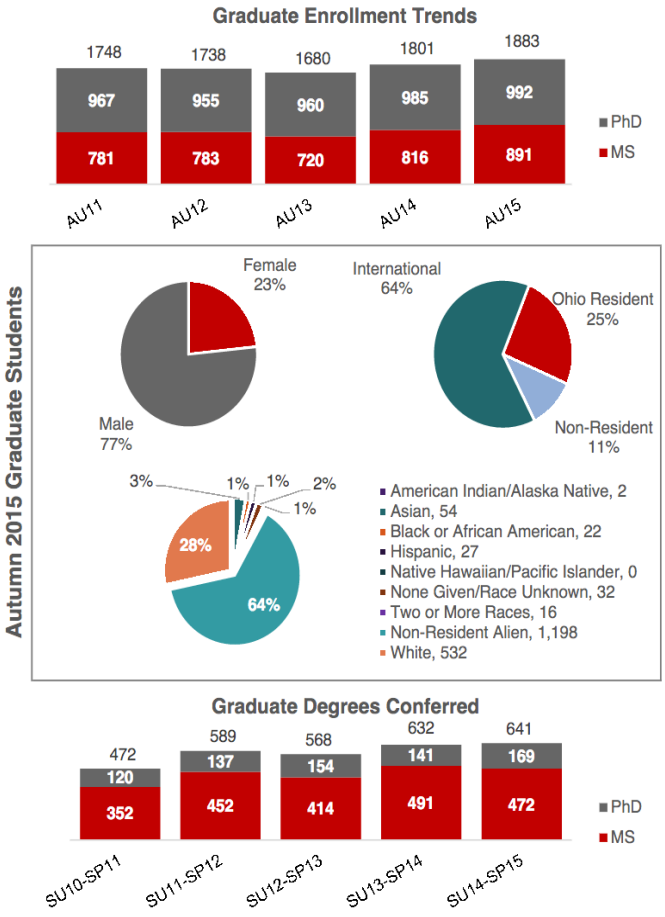

Figure 1. Engineering graduate enrollment trends *(OSU College of Engineering, 2016)*

b. Comparison of underrepresented groups degree recipients from the department and university at all levels compared to national norms

Based on annual data collected by the American Society for Engineering Education, 24% of master's students and 22% of doctoral candidates in U.S. colleges of engineering are women. OSU's College of Engineering is very close to national norms with women comprising 23% of the engineering graduate student numbers. Increasing the numbers of faculty role models is also important. Recently, *US News and World Report* stated that nationally only 15.2% of tenure-track engineering faculty are women, and only 2.5% and 3.9% of tenure-track engineering faculty are African-American or Hispanic, respectively (Morella, 2016). In comparison, at Ohio State, women hold 20% of the tenure-track engineering faculty positions, and underrepresented minorities hold 5% of tenure-track positions (OSU College of Engineering, 2016). Across OSU, women make up 39 % of all faculty which includes tenure track, clinical and research but does not include instructors and lecturers (OSU The Women's Place, 2017). Faculty in the Department of Engineering Education are more diverse than elsewhere in the college and university, with 57% of the tenure-track faculty being women and 29% being underrepresented minorities. Among the unit's clinical faculty, 40% are women.

8. *Availability and adequacy of the faculty and facilities available for the new degree program.*

a. Competency, experience and number of faculty

The Department of Engineering Education (EED) is currently supported by 38 faculty (tenure-track, clinical, and lecturers) and five staff. The faculty have the appropriate background, training, and experience to guide graduate students in doctoral research as evidenced in their CVs (Appendix 1). The research infrastructure at OSU is well positioned to support engineering education faculty in their grant activity. The department recently hired a new staff member for the position of graduate coordinator.

A summary of our current and projected faculty is shown in Table 1 along with their Graduate Faculty “P” status. The EED has achieved OSU’s minimum required departmental faculty of ten (we have eleven). We currently have seven faculty who hold “P” status in other departments or are eligible to do so once we have a degree program, and we have approval from the College of Engineering to hire two more tenure-track faculty in the next two years. Additionally, there are three STEM faculty with “P” status from the College of Education and Human Ecology (EHE) who have been offered courtesy appointments and who will be active in advising or co-advising our students. Our Associate Dean, a professor in Chemical and Biomolecular Engineering, also has a courtesy appointment with “P” status. Thus in total, we have eleven faculty with “P” status affiliated with the proposed doctoral program with two more to be added over the next two years.

Table 1. Current Faculty Status

Faculty Name	Title	P-Status	Comments
Monica Cox	Professor and Chair	Eligible	
Ann Christy	Professor and Asst. Dean	Yes	
Jeffrey Froyd	Professor	Eligible	
David Delaine	Assist. Professor	Eligible	
Rachel Kajfez	Assist. Professor	Eligible	
Emily Drinkenberg	Assist. Professor	Eligible	
David Tomasko	Professor and Assoc. Dean	Yes	Courtesy Appointment
Paul Post	Asst. Professor (EHE)	Yes	Courtesy Appointment
Karen Irving	Assoc. Professor (EHE)	Yes	Courtesy Appointment
Lin Ding	Assoc. Professor (EHE)	Yes	Courtesy Appointment
New Tenure Track	Assist. Professor	Eligible	Planned Hire 2018
New Tenure Track	Professor	Eligible	Planned Hire 2019
Rick Freuler	Professor of Practice	No	M-status
Peter Rogers	Professor of Practice	No	M-status
Deb Grzybowski	Assoc. Professor of Practice	Yes	
Krista Kecskemety	Asst. Professor of Practice	No	M-status eligible
Denver Tang	Asst. Professor of Practice	No	M-status eligible

b. Support and commitment of the proposing institution's central administration

The institution's central administration indicated their support and commitment by the University Senate's vote on October 29, 2015, to approve a proposal recommending establishment of a new Department of Engineering Education at OSU. This recommendation was acted upon by the University Board of Trustees on November 6, 2015 when they voted to establish the new department. That proposal was solely about transitioning the unit from a college center to a department, (i.e., a change in administrative structure), but it did indicate general plans to develop a Ph.D. program to grow the field of engineering education and to support the tenure-track faculty who are now calling the new department their TIU home.

c. Adequacy of available resources committed for the initiation of the program.

The Fiscal Year 2016 budget for the Engineering Education Innovation Center (EEIC), which transitioned into the Department of Engineering Education on November 6, 2015, was $5.8M. In 2015-2016, the department supported 32 graduate teaching assistants (GTAs), one graduate research associate (GRA), 125 undergraduate teaching assistants (UTAs), and two undergraduate researchers. The ratio of GRAs to GTAs is expected to increase with the inauguration of this new Ph.D. program, along with the number of fellowship recipients. For 2016-2017 the Department of Engineering Education employed 44 Faculty and Staff, 22 GTAs, 2 GRAs, and 168 UTAs.

The College of Engineering has committed to the recruitment and hiring of faculty who will ensure the success of our Ph.D. program. By the end of the 2017-18 hiring cycle, nine faculty in the EED will have or be eligible for "P" status. We are forming partnerships that will include joint and courtesy appointments also, thereby increasing the likelihood that co-advising will occur with faculty across different OSU Colleges.

d. **Adequacy of available resources committed for the initiation of the program.**

OSU has excellent computational facilities and support. Wireless internet connectivity is available in every building on campus. The College of Engineering has a wide selection of engineering-specific hardware and networked software which is made available to students at more than a dozen locations across the college. Included in Hitchcock Hall, our departmental home, is a student computer laboratory which is part of the College of Engineering's computer network and is available 24 hours per day to undergraduate and graduate engineering students. The laboratory has color and black-and-white printers, scanning capability, and large format printers, plotters, and scanners. A student lab-room monitor and/or a service desk area are available for troubleshooting and consultation during posted hours.

University Libraries at Ohio State have a combined collection of nearly 5.8 million volumes and annually receive approximately 35,000 serial titles. University Libraries consists of the Thompson (Main) Library and fourteen other specialized libraries. There are collections in agriculture, art, life and physical sciences, economics, education, engineering, human ecology, journalism, music, psychology, pharmacy, social work, and more. Each library provides access to the Libraries' online catalog/circulation system, as well as to indexes, abstracts, and bibliographies pertinent to its subject area(s). Librarians familiar with the subject areas and expert in associated research techniques are available for consultation research. University Libraries is also a member of OhioLINK, a statewide library and information network linking the major academic and community college libraries in Ohio with the State Library.

Serving the education research community, the William Oxley Thompson (Main) Library houses the university's collections in humanities and social sciences including education. Built in 1913 and most recently renovated in 2009, it is an 11-story building with 306,000 square feet of space. Serving the engineering research community, the 18th Avenue Library houses the university's collections in Engineering, Architecture, Astronomy, Chemistry, Physics, Mathematics, Music, and Dance. Built in 1993, it is a five-story building with just under 70,000 square feet and 24-hour access (with a valid OSU ID). The University Library developed and hosts an online research guide specifically related to engineering education <http://guides.osu.edu/engineering education>. This resource for faculty, staff, and students includes links to databases, journals, eBooks, and dissertations in the field of engineering education.

Classrooms and instructional spaces serve as laboratories for some research specializations within engineering education. Departmental faculty currently teach more than 8,000 credit hours per semester including providing instruction to all first-year engineering students and a wide range of other undergraduate students in courses not offered by other units in the College of Engineering. Engineering Education faculty also teach graduate courses in areas such as research methodology, engineering education foundations, and effective college teaching. All of the department's undergraduate courses are taught in dedicated and specially-constructed instructional spaces. Most instructional spaces have a computer workstation for each student. All instructional spaces have video display systems and audio enhancement. Most assigned instructional rooms are in Hitchcock Hall and have a furniture layout conducive to student team collaboration, with teams of four students being typical. Student tables are, in general, of working height (39 inches) with some furniture having accommodation for students with disabilities. There are two larger multipurpose rooms having in-room shelving which allows for readily available curriculum-related items. Two other classrooms in Caldwell Lab and one classroom in Dreese Lab are dedicated to offering the department's engineering technical communication courses.

Technical engineering laboratories include space in Hitchcock Hall and Smith Laboratory that support our experiential programs and courses including the First-Year Engineering Program, Engineering Technical Communications, Integrated Business and Engineering, and Multidisciplinary Capstone. This space includes student work space, storage space, creative instructional space, and prototyping equipment. Prototyping areas feature hand tools and clear areas for construction and assembly, floor and bench mounted machines (e.g., drill presses, milling machines, grinders and sanders), and rapid prototyping 3-D printers. Recently acquired space and reallocated space has created a designated research space that is used exclusively to house research faculty, staff, and students.

The majority of faculty offices are in Hitchcock Hall. The Department of Engineering Education has a dedicated conference room and several other rooms available in Hitchcock Hall and Smith Lab to schedule general meetings, research interviews, and professional presentations. It also has dedicated space to support researchers including graduate teaching and research associates (GTAs and GRAs), postdoctoral

professionals, visiting scholars, and other research support staff. More space is needed given the faculty hiring plan and the increased numbers of undergraduate and graduate students served by the department.

9. ***Need for additional facilities and staff and the plans to meet.***

Two additional tenure-track faculty are needed, and OSU's College of Engineering has agreed to authorize these faculty hires over the next two years. In August 2017, the department hired a graduate program coordinator, under an A&P staff position. Facilities are adequate, but further expansion of the program will require additional space and/or creative changes in usage of existing departmental space.

10. ***Projected additional costs associated with the program and evidence of institutional commitment and capacity to meet these costs.***

Projected additional costs specifically associated with the proposed graduate program include faculty salaries and start-up packages, recruiting faculty and Ph.D. students, graduate student funding (stipends, tuition, and fees including student health insurance), and professional development/conference attendance funds for graduate students on a competitive basis. These additional costs are supported by a combination of university and college fellowships, research grants, teaching assistantships, new faculty start-up allocations, development funds, and other departmental funding. The department's large teaching commitment, serving more than 3500 undergraduates annually, means that there is an assured pool of more than twenty graduate teaching assistantships (GTAs) available each year, although not all of these GTA positions will always be filled by engineering education doctoral students. This provides a solid basis for supporting the proposed doctoral program in engineering education at the Ohio State University.

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Appendices

1. Faculty Curriculum Vitae
2. Curriculum
    a. Program goals, learning outcomes, and levels of proficiency
    b. Curricular map
    c. Example semester-by-semester plans
    d. Student advising sheet
    e. Examples of Engineering Education Doctoral Dissertation Titles from Purdue University and Virginia Tech (2006-2015)
3. Course Syllabi
4. Assessment Plan (TracDat)
5. Needs Survey
6. Letter of Support
7. Fiscal Impact Statement (template, data to be added later)

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Education

Ph.D. Leadership and Policy Studies, 2005. Vanderbilt University, Nashville, TN
M.S. Industrial Engineering, 2000. University of Alabama, Tuscaloosa, AL
B.S. Mathematics, 1998. Spelman College, Atlanta, GA

Employment History

Professor & Inaugural Department Chair, Department of Engineering Education, The Ohio State University, Columbus, OH (2015-present)
Associate Professor of Engineering Education, Purdue University, West Lafayette, IN (2005-2015)
Chief Executive Officer, STEMinent LLC (2013-present)
Inaugural Director, Engineering Leadership Minor, Purdue University, West Lafayette, IN (2012-present)
Interim Statewide Director, Louis Stokes Alliance for Minority Participation, Purdue University, West Lafayette, IN (2011-2014).

Publications (Summary)

- Peer-reviewed journal articles: 31
- Proceedings and abstracts: 68
- Chapters in edited books: 6
- Bulletins, tech reports, and fact sheets: 3

Courses Taught in Engineering Education (Taught at Purdue University, arrived at OSU in January 2016)

1. Seminar in Engineering Education (ENE 695A)
2. Introduction to Engineering and Purdue (ENGR 103)
3. Instruction, Mentorship, and Leadership (ENGR 404)
4. Problem Solving & Design for Diverse Learners (ENE 695C)
5. Engineering Problem Solving and Computer Tools (ENGR 126)
6. Leadership, Policy, & Change in STEM Education (ENE 695I)
7. Effective Teaching of Engineering: Linking Theory and Practice (ENE 595G)
8. Transforming Ideas to Innovation I (ENGR 19500)
9. Harnessing Engineering Expertise (ENE 695)
10. Planning for Engineering Leadership Development (ENE 195)
11. E-Portfolio: Experience Engineering Leadership (ENE 195)

Graduate Student Advising

- PhD students advised: 10 graduated (Engineering Education Ph.D.s, Purdue University)

Selected Recent Publications (Engineering Education Journal Articles)

1. Bairaktorova, D., Cox, M.F., & Evangelou, D. (2012). Leadership Training in Science, Technology, Engineering, and Mathematics (STEM) Education in Bulgaria. *European Journal of Engineering Education, 36,* 6, 585-594.
2. Bernstein, W.Z., Ramanujam, D., Zhao, F., Ramani, K., & Cox, M.F. (2012). Teaching Design for Environment through Critique within a Project Based Product Design Course. *International Journal of Engineering Education, 28,* 4, 1-12.
3. Cox, M.F., Ahn, B., Cekic, O., & Zhu, J. (2012). Engineering Professionals' Expectations of Undergraduate Engineering Students. *Leadership and Management, 12,* 2, 60-70.
4. Mendoza-Diaz, N. & Cox, M.F. (2012). An Overview of the Literature: Research in P-12 Engineering Education. *Advances in Engineering Education, 3,* 2, 37 pages.
5. Cox, M.F., Mendoza-Diaz, N., & Adams, S.G. (2013). Elementary Educators' Perceptions of Design, Engineering, and Technology: An Analysis by Ethnicity. *Journal of STEM Education, 14,* 3, 13.
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10. London, J., Cox, M.F., Ahn, B., Branch S., Torres-Ayala, A., Zephirin, T., & Zhu, J. (2014). Motivations for Pursuing an Engineering Ph.D. and Perceptions of its Added Value. *International Journal of Doctoral Studies, 9,* 205-227.
11. Ahn, B., Cox, M.F., Zephirin, T., Haller, Y, Groll, E., Taylor, K., Davenport Sypher, B., & Adams, S. (2014). Development of Professional Workshop to Cultivate Professional Skills among Engineering Managers: Lessons Learned from a Professional Development Workshop. *International Journal of Engineering Education, 30,* 1621-1635.
12. Berdanier, C. G., & Cox, M. F. (2015). Research and Assessment of Learning Environments through Photoelicitation: Graduate Student Perceptions of Electronics Manufacturing in India. *Advances in Engineering Education, 4*(4), n4.
13. Bairaktarova, D., Cox, M.F., & Srivastava, M. (2015). A Project-Based Approach to Professional Skills Training in an Undergraduate Engineering Curriculum. *International Journal of Engineering Education, 31,* 1, 425-433.
14. Berdanier, C. G., & Cox, M. F. (2015). Research and Assessment of Learning Environments through Photoelicitation: Graduate Student Perceptions of Electronics Manufacturing in India. *Advances in Engineering Education,* 4(4), n4.
15. Berdanier, C.G.P, Tally, A., Branch, S.E., Ahn, B., & Cox, M.F. (2016). A strategic blueprint for the alignment of doctoral competencies with disciplinary expectations, *International Journal of Engineering Education,* 32, 4, 759-1773.

Honors and Awards

- Purdue University College of Engineering Faculty Award of Excellent for Leadership (2014)

- Purdue University Entrepreneurial Leadership Academy Fellow (2013)
- Purdue Black Graduate Student Association (BGSA) Engagement Award Recipient (2013)
- Presidential Early Career Award for Scientists and Engineers (PECASE) Recipient (2008)
- Diverse Issues in Higher Education Emerging Scholar (2008)
- National Science Foundation Early Faculty CAREER Award Recipient (2007)
- National Academies of Engineering/Center for the Advancement of Scholarship in Engineering Education New Faculty Fellow, Frontiers in Education Conference (2006)
- Purdue University Teaching for Tomorrow Award Recipient (2006-2007)
- Vanderbilt University Department of Leadership, Policy, and Organizations Graduate Student Representative (2002-03)*
- VaNTH Engineering Research Center Student Leadership Council Chairperson (2001-2005)
- Vanderbilt University Posse Foundation/Dean's Graduate Fellow (2000-05) University of Alabama Graduate Council Fellow (1999-2000)
- University of Alabama National Alumni Association Fellow (1998-99)
- NASA/Graduate Degrees for Minorities in Engineering and Science (GEM) Scholar (1998-2000)
- Spelman College NASA/Women in Science and Engineering (WISE) Scholar (1994-98)

Inter-Institutional Collaborations

- Cornell University (Co-PI)
- Howard University (Advisory Board Member)
- Indiana University (Co-PI)
- Indiana University-Purdue University Indianapolis (Co-PI)
- Ivy Tech Community College (co-PI)
- Norfolk State University (Co-PI)
- Purdue University (Co-Author, PI, Co-PI)
- Rose-Hulman Institute of Technology (Co-Author)
- Shanghai Jiao Tong University (Co-Author)
- Universidad de Las Americas Puebla (Mexico) (Visiting Professor)
- University of Pittsburgh (Co-Author)
- Vanderbilt University (PI)
- Virginia Polytechnic Institute and State University (Engineering Education Advisory Board Member)

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Education

Ph.D. Environmental Systems Engineering, 1991. Clemson University, Clemson, SC.
M.S. Biomedical Engineering, 1985. The Ohio State University, Columbus, OH.
B.S. Agricultural Engineering, 1983. The Ohio State University, Columbus, OH.

Employment History

Professor, Department of Engineering Education, The Ohio State University, Columbus, OH (2016-present).
Professor, Department of Food, Agricultural, and Biological Engineering (FABENG), The Ohio State University, Columbus, OH (1996-present).
Senior Associate Engineer / Board of Directors member, Bennett and Williams Environmental Consultants Inc., Westerville, OH (1999-present part-time).
Interim Director, Engineering Education Innovation Center, College of Engineering, The Ohio State University, Columbus, OH (2014-2015)
Provost Faculty Fellow, Office of Academic Affairs, The Ohio State University, Columbus, OH (2009-2012*)*
Interim Associate Dean for Undergraduate Education and Student Services, College of Engineering, The Ohio State University, Columbus, OH (2008-2009*)*.
Senior Engineer, Killam Associates Consulting Engineers, Millburn, NJ (1992-1995 full time, 1996-1999 part-time).

Professional Registration and Certifications

- Registered Professional Engineer, State of Ohio (1996 -present)
- ABET Engineering Accreditation Commission (ABET-EAC) program evaluator (2009 – present)
- American Council for Construction Education (ACCE) program evaluator (2008-2013)

Courses Taught at the Ohio State University (OSU), Columbus, Ohio

1. Fundamentals of Engineering II for Honors (ENGR 1282.01H)
2. Introduction to Food, Agricultural, and Biological Engineering (FABENG 225)
3. Modeling and Design of Biological Systems (FABENG 625)
4. Environmental Controls for Agricultural Structures (FABENG 645, 5820)
5. Design of Waste Management Systems (FABENG 650)
6. Thermodynamics (FABENG 2120, 3120)
7. Biomass Conversion to Bioenergy (FABENG 5540)
8. Science and Engineering for Life – On Earth and in Space (FABENG 694 Group studies for high school science teachers)
9. Professional Development (FABENG 695, 3140)
10. Sustainable Housing for Informal Settlements in South Africa (an OSU Study Abroad program, FABENG 697.01)
11. Capstone Design (FABENG 723, 724, 725)
12. Departmental / Graduate Seminar (FABENG 850)
13. College Teaching in Engineering (FABENG 7220)

Graduate student advising:

- PhD students advised: 5 graduated (4 FABENG, 1 Env. Sci.)
- Masters students advised: 11 graduated (9 FABENG, 1 Env. Sci., 1 Historic Preservation), 2 current (FABENG)

Publications (Summary):

- Peer-reviewed journal articles: 33
- Proceedings and abstracts: 87 (34 peer-reviewed)
- Chapters in edited books: 2
- Bulletins, tech reports, and fact sheets: 9
- Editor-reviewed journal articles: 8

Selected recent publications (Engineering education related):

1. Lima, M., and Christy, A.D. 2017. Service learning in biological and agricultural engineering: Journeys in community engagement. *ASEE Annual Conference,* American Society for Engineering Education. Paper No. AC 2017-20133. 7 p. (Peer reviewed)
2. Christy, A.D., and Fasina, O. 2017. Student ePortfolios for undergraduate professional development: A comparison of two programs. *ASEE Annual Conference,* American Society for Engineering Education. Paper No. AC 2017-20035. 7 p.
3. Christy, A. D. 2014. Students' selection of topics for a professional development course. *2014 ASEE Annual Conference,* American Society for Engineering Education. ASEE Paper # AC 2014-10643. 5 p.
4. Christy, Ann D. 2013. "Student portfolios for assessing ABET a-k outcomes." *Proceedings of the 2013 ASEE North Central Section Conference*. 12 p.
5. Chen, Q., A.D. Christy, M.E. Owens, D. Bortz, W. Greene, and B. King. 2012. Two-plus-two construction management programs and articulation agreements. *International Journal of Construction Education and Research*. 8(1): 4-25.
6. Christy, A.D. 2011. Engaging Students to Prepare them for the Engineering Profession and Reflect upon their Undergraduate Career. ASABE Paper No.11-11605. St. Joseph, Mich: ASABE. 8p.
7. Owens, Margaret, Qian Chen, Ann Christy, Wesley Greene, and Ben King. 2010. Articulation between 2-Year and 4-Year Construction Management Programs. *ASC International Proceedings of the 46th Annual Conference*, Associated Schools of Construction. Boston, MA. April 7-10, 2010. 8 p.
8. Ward, Andy, Ann Christy, Robert Gustafson, Jessica D'Ambrosio, and Kurt Paterson. 2009. Globalizing Engineering Education: Lessons Learned from Africa and USA Partnerships. *2009 ASEE Annual Conference,* American Society for Engineering Education. June 15-17, 2009. Paper # AC 2009-2207. 16 p.
9. Abadie, A., A.D. Christy, J. Jones, J. Wang, and M. Lima. 2009. Longitudinal survey of female faculty in biological and agricultural engineering. *Transactions of the ASABE* 52(4): 1397-1405.
10. Christy, Ann, Andy Ward, Jeff Hughes, Simon Lorentz, and Bethany Corcoran. 2008. An Experiential and Service Learning Capstone design Initiative in South Africa. *2008 ASEE Global Colloquium,* American Society for Engineering Education. CapeTown, South Africa, October 2008. Paper # GC 2008-124. 11 p.
11. Christy, A.D., and M. Lima. 2007. Teaching creativity and multidisciplinary approaches to engineering problem-solving. *International Journal of Engineering Education* 23(4): 636-644.
12. Ward, Andy D., Kerry Hughes Zwierschke, Carol Moody, and Ann D. Christy. 2007. Developing Sustainable Solutions for Impoverished Communities in South Africa: A Student Centered and Service Learning Capstone Design Experience. *American Society of Agricultural and Biological Engineers Annual Meeting.* ASABE Paper 07-8018. 8 p.
13. Christy, Ann D., Margaret E. Owens, and Mary J. Faure. 2007. Student Portfolios, Business Communications, Engineering Poetry Contests, and Grading Multiple Drafts of Technical Writing Documents. *American Society of Agricultural and Biological Engineers Annual Meeting.* ASABE Paper 07-8001. 7 p.
14. Graf, Julie A., and Ann D. Christy. 2006. Assessing perceptions of education: A case for increased interdisciplinarity. *American Society of Agricultural and Biological Engineers Annual Meeting.* ASABE Paper 06-8001. 16 p.
15. Christy, A.D., Karen M. Mancl, and Michael Rowan. 2005. Co-teaching an engineering class with an agricultural technology management class on the topic of waste and wastewater treatment. *American Society of Agricultural Engineers Annual Meeting*. ASAE Paper 05-8009. 5 p.
16. Christy, A.D., and J. Graf. 2005. Departmental to inter-collegiate engineering poetry contests. *2005 ASEE Annual Conference*, American Society for Engineering Education. June 2005. 9 p. (Peer reviewed).
17. Christy, A.D. 2004. Renaissance learning and poetry contests in biological and agricultural engineering. *2004 ASEE Annual Conference*, American Society for Engineering Education. June 2004. 6 p.
18. Hughes, K.L., and A.D. Christy. 2002. Biological engineering education and the biology knowledge

explosion: Lessons from biology educators. *American Society of Agricultural Engineers Annual Meeting.* ASAE Paper 02-7030. 8 p.

19. Owens, Margaret E., James C. Papritan, and Ann D. Christy. 2002. The Student Portfolio as an Assessment Tool in Agricultural and Construction Health and Safety Courses. *Meeting of the National Institute for Farm Safety, Inc.,* 14 p.

20. Hughes, K.L., D.A. Farver, A.D. Christy, and M. Lima. 2001. A review of currently available texts for biological engineering courses. *2001 ASEE Annual Conference Proceedings,* American Society for Engineering Education. 6 p.

21. Christy, A.D., and J. Weatherington-Rice. 2000. Field workshop on subsurface fractures in glacial till and their environmental implications: An educational experience for professionals and decision makers. *Ohio Journal of Science* 100(3/4): 94-99.
22. Christy, A.D., M. Lima, and A.D. Ward. 2000. Implementing real-world problem solving projects in a team setting. *National Association of Colleges and Teachers of Agriculture Journal* 44(3): 72-77.
23. Cauble,S.,A.D.Christy, M. Lima. 2000. Toward plugging the leaky pipeline: Biological and agricultural engineering female faculty in the United States and Canada. *Journal of Women and Minorities in Science and Engineering* 6(3): 229-249.
24. Christy, A.D., M. Lima, E.C. Alocilja, J.C. Papritan, M.E. Owens, and M.H. Klingman. 2000. The use of student portfolios to enhance learning, industrial ties, and accreditation in biological engineering education. *American Society of Agricultural Engineers Annual Meeting*. ASAE Paper 00-8014. 11 p.
25. Lima, M., A.D. Christy, M. Owens, and J.C. Papritan. 1999. The use of student portfolios to enhance learning and encourage industrial ties in undergraduate education. *NACTA Journal* 43(3): 51-54.
26. Christy, A.D., and M. Lima. 1999. Biological engineering student design projects with real clients. *1999 ASEE Annual Conference Proceedings*, American Society for Engineering Education. 7p.
27. Cauble, S., A.D. Christy, and M. Lima. 1999. A survey of biological and agricultural engineering female faculty in North America. *1999 ASEE Annual Conference Proceedings*, American Society for Engineering Education. 11p.
28. Christy, A.D. and M. Lima. 1998. The use of student portfolios in engineering instruction. *Journal of Engineering Education* 87(2): 143-148.

Honors and Awards

- Massey-Ferguson Educational Gold Medal Award, American Society of Agr. and Biological Engineers (2017)
- The Ohio State University President and Provost's Award for Distinguished Faculty Service (2017)
- Department of Engineering Education Outstanding Service to the Department Award (2017)
- U.S. Department of Agriculture National Award for Excellence in College and University Teaching (2016)
- Recipient of the Ohio State University Board of Trustees "Resolution of appreciation for the leadership vital in developing strategies and a structure to implement the transition of The Ohio State University from the quarter to semester system," Resolution No. 2012-100 (2012)
- Star Student Supporter Award, College of Food, Agr., and Environmental Sciences' Student Council (2012)
- The Ohio State University Alumni Award for Distinguished Teaching (2007)
- OARDC William E. Krauss Award for Excellence in Graduate Research, Faculty Advisor Award (2007)
- U.S. Department of Agriculture North Central Regional Award for Excellence in College and University Teaching (2005)
- Boyer Award for Excellence in Teaching Innovation, OSU College of Engineering (2005)
- Charles E. MacQuigg Student Award for Outstanding Teaching, OSU College of Engineering (2004)
- Teaching Award of Merit, Ohio State Chapter of Gamma Sigma Delta (2003)

Inter-institutional collaborations

- Columbus State Community College (co-author)
- Louisiana State University (co-author, co-PI)
- North Carolina State University (co-PI)
- University of Kentucky (co-author)
- University of Illinois (co-PI)
- University of Nebraska -Lincoln (co-PI)

Industry collaborations

- Bennett and Williams Environmental Consultants Inc. (co-author, Board of Directors member)

Jeffrey E. Froyd, Ph.D.

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Education

Ph.D. Electrical Engineering, 1979. University of Minnesota – Twin Cities, Minneapolis, MN.
M.S. Electrical Engineering, 1975. University of Minnesota – Twin Cities, Minneapolis, MN.
B.S. Mathematics, 1974. Rose-Hulman Institute of Technology, Terre Haute, IN.

Employment History

Professor, Department of Engineering Education, The Ohio State University, Columbus, OH (2017- present)
Research Professor, Engineering Academic and Student Affairs, College of Engineering, Texas A&M University, College Station, TX (2011-2017).
Director of Faculty Climate and Development, Office of the Dean of Faculties and Associate Provost, Texas A&M University, College Station, TX (2007-2011).
Research Professor, Center for Teaching Excellence, Texas A&M University, College Station, TX (2004-2007).
Project Director, Foundation Coalition, Texas A&M University, College Station, TX (2001-2004)
Visiting Professor, Department of Electrical and Computer Engineering, College of Engineering, Texas A&M University, College Station, TX (1999-2001*)*
Professor, Department of Electrical and Computer Engineering, Rose-Hulman Institute of Technology, Terre Haute, IN (1990-1999*)*.
Senior Systems Engineer, Applied Computing Devices, Terre Haute, IN (1992-1993, sabbatical).
Associate Professor, Department of Electrical and Computer Engineering, Rose-Hulman Institute of Technology, Terre Haute, IN (1984-1990*)*.
Assistant Professor, Department of Electrical and Computer Engineering, Rose-Hulman Institute of Technology, Terre Haute, IN (1981-1984).

Professional Registration and Certifications

- ABET Engineering Accreditation Commission (ABET-EAC) program evaluator (1999 – present)

Courses Taught at Rose-Hulman Institute of Technology, Terre Haute, IN

1. Integrated, First-year Curriculum in Science, Engineering, and Mathematics (SEM 101, SEM 102, SEM 103, 12 credit hours each quarter)
2. Design of Feedback Systems (EE 471)
3. Control Systems I (EE 572)
4. Control Systems II (EE 573)
5. Electrical Circuits I (EE 211)
6. Electrical Circuits II (EE 212)
7. VLSI Design I (EE 581)
8. VLSI Design II (EE 582)
9. VLSI Design III (EE 583)
10. Engineering Design I (EE 460)
11. Engineering Design II (EE461)

Publications (Summary):

- Peer-reviewed journal articles: 22
- Proceedings and abstracts: 67 (60 peer-reviewed)
- Book: 1
- Chapters in edited books: 1

Selected recent publications (Engineering education related):

1. Stanford, C., Cole, R. Cole, Froyd, J. E., Henderson, C., Friedrichsen, D., & Khatri, R. (2017). Analysis of propagation plans in NSF-funded education development projects, *Journal of Science Education and Technology*, doi: 10.1007/s10956-017-9689-x
2. Taylor, L. L., Beck, M. I., Lahey, J. I., & Froyd, J. E. (2017). Reducing Inequality in Higher Education: The Link between Faculty Empowerment and Climate and Retention, *Innovative Higher Education*, doi: 10.1007/s10755-017-9391-1
3. Khatri, R., Henderson, C., Cole, R. S., Froyd, J. E., Friedrichsen, D., & Stanford, C. (2017). Characteristics of well-propagated teaching innovations in undergraduate STEM. *International Journal of STEM Education, 4*(2), 1-10. doi:10.1186/s40594-017-0056-5
4. Stanford, C., Cole, R. S., Froyd, J. E., Friedrichsen, D., Khatri, R., & Henderson, C. (2016). Supporting sustained adoption of education innovations: The Designing for Sustained Adoption Assessment Instrument. *International Journal of STEM Education, 3*(1), 1-13. doi:10.1186/s40594-016-0034-3
5. Khatri, R., Henderson, C., Cole, R., Froyd, J. E., Friedrichsen, D., & Stanford, C. (2016). Designing for sustained adoption: A model of developing educational innovations for successful propagation. *Physical Review Physics Education Research, 12*(1), 010112-1-22. doi:10.1103/PhysRevPhysEducRes.12.010112
6. Borrego, M., Foster, M. J., & Froyd, J. E. (2015). What is the state of the art of systematic review in engineering education? *Journal of Engineering Education, 104*(2), 212-242. 10.1002/jee.20069
7. Borrego, M., Foster, M. J., & Froyd, J. E. (2014). Systematic literature reviews in engineering education and other developing interdisciplinary fields. *Journal of Engineering Education, 103*(1), 45-76. doi: 10.1002/jee.20038
8. Atilhan, M., ElJack, F., Alfadala, H., Froyd, J. E., El-Halwagi, M., & Mahalec, V. (2014). Inquiry guided learning in a chemical engineering core curriculum: General instructional approach and specific application to the fluid mechanics case. *International Journal of Engineering Education, 30*(6), 1450-1460. Retrieved from http://www.ijee.ie/contents/c300614A.html
9. Borrego, Maura, Cutler, Stephanie, Prince, Michael J., Henderson, Charles, & Froyd, Jeffrey E. (2013). Fidelity of implementation of research-based instructional strategies (RBIS) in engineering science courses. *Journal of Engineering Education, 102*(3), 394-425. doi: 10.1002/jee.20020
10. Borrego, Maura, Froyd, Jeffrey E., Henderson, Charles, Cutler, Stephanie, & Prince, Michael J. (2013). Influence of engineering instructors' teaching and learning beliefs on pedagogies in engineering science courses. *International Journal of Engineering Education, 29*(6), 1-16.
11. Prince, Michael J., Borrego, Maura, Cutler, Stephanie, Henderson, Charles, & Froyd, Jeffrey E. (2013). Use of research-based instructional strategies in core chemical engineering courses. *Chemical Engineering Education, 47*(1), 27-37.
12. Froyd, Jeffrey E., Borrego, Maura, Cutler, Stephanie, Henderson, Charles, & Prince, Michael J. (2013). Estimates of use of research-based instructional strategies in core electrical or computer engineering courses. *IEEE Transactions on Education, 56*(3). doi: 10.1109/TE.2013.2244602
13. Froyd, Jeffrey E., Wankat, Phillip C., & Smith, Karl A. (2012). Five major shifts in 100 years of engineering education. *Proceedings of the IEEE, 100*(13), 1344-1360. doi: 10.1109/JPROC.2012.2190167
14. Froyd, J. E., Hurtado, L. D., Lagoudas, M. Z., Nite, S., Hobson, M., Hodge, J. & Monroe, J. (2012) *Increasing Access to Engineering*. Paper presented at the Frontiers in Education Conference. doi: 10.1109/FIE.2012.6462265
15. Cutler, Stephanie, Borrego, Maura, Henderson, Charles, Prince, Michael J., & Froyd, Jeffrey E. (2012). *A comparison of electrical, computer, and chemical engineering facultys' progressions through the innovation-decision process*. Paper presented at the Frontiers in Education Conference, Seattle, WA. doi: 10.1109/FIE.2012.6462405
16. Shryock, Kristi J., Srinivasa, Arun R., & Froyd, Jeffrey E. (2011). *Developing instruments to assess first-year calculus and physics mechanics skills needed for a sophomore statics and dynamics course*. Paper presented at the Frontiers in Education Conference, Rapid City, SD, USA. doi: 10.1109/FIE.2011.6142722
17. Shryock, K. J., Srinivasa, A. R., & Froyd, J. E. (2011). *Alignment of preparation via first-year physics mechanics and calculus courses with expectations for a sophomore statics and dynamics course*. Paper presented at the ASEE Annual Conference & Exposition. Retrieved November 14, 2011 from https://peer.asee.org/17434
18. Shryock, K. J., Srinivasa, A. R., & Froyd, J. E. (2011). *Assessing first-year calculus knowledge and skills needed for a sophomore statics and dynamics course*. Paper presented at the ASEE Annual Conference & Exposition. Retrieved November 14, 2011 from https://peer.asee.org/17519
19. Shryock, K. J., Srinivasa, A. R., & Froyd, J. E. (2011). *Assessing first-year physics mechanics knowledge and*

skills needed for a sophomore statics and dynamics course. Paper presented at the ASEE Annual Conference & Exposition. Retrieved November 14, 2011 from https://peer.asee.org/17520
20. Shryock, K. J., Srinivasa, A. R., & Froyd, J. E. (2011). *Preparing engineering students to take a calculus course: An engineering-oriented approach*. Paper presented at the ASEE Annual Conference & Exposition. Retrieved November 14, 2011 from https://peer.asee.org/18704
21. Ulseth, R. R., Froyd, J. E., Litzinger, T. A., Ewert, D., & Johnson, B. M. (2011). *A new model of project based learning*. Paper presented at the ASEE Annual Conference & Exposition. Retrieved November 14, 2011 from https://peer.asee.org/17360
22. Litzinger, T. A., Zappe, S. E., Borrego, M. J., Froyd, J. E., Newstetter, W., Tonso, K. L., et al. (2011). *Writing effective evaluation and dissemination/diffusion plans*. Paper presented at the ASEE Annual Conference & Exposition. Retrieved November 14, 2011 from https://peer.asee.org/18994
23. Hodge, J. Q., Lagoudas, M. Z., Harris, A. M., Froyd, J. E., Hobson, M., & Pope, J. A. (2011). *Influencing the academic success of undergraduate first-year engineering students through a living learning community*. Paper presented at the ASEE Annual Conference & Exposition. Retrieved November 14, 2011 from https://peer.asee.org/18160
24. Froyd, J. E., Schwartz, C. J., & Rajagopal, K. R. (2011). *Comprehensive course redesign: Introduction to the mechanics of materials*. Paper presented at the ASEE Annual Conference & Exposition. Retrieved November 14, 2011, from https://peer.asee.org/17638
25. Borrego, Maura, Froyd, Jeffrey E., & Hall, T. Simin. (2010). Diffusion of engineering education innovations: A survey of awareness and adoption rates in U.S. engineering departments. *Journal of Engineering Education, 99*(3), 185-207. doi: 10.1002/j.2168-9830.2010.tb01056.x
26. Fowler, D. A., Froyd, J. E., & Layne, J. (2010). *Curriculum Redesign: Concurrently Addressing Content Mastery and Development of Cognitive Abilities*. Paper presented at the Frontiers in Education Conference. doi: 10.1109/FIE.2010.5673605
27. Merton, P., Froyd, J. E., Clark, M. C., & Richardson, J. (2009). A case study of relationships between organizational culture and curricular change in engineering education. *Innovative Higher Education, 34*(4), 219–233. doi: 10.1007/s10755-009-9114-3
28. Watson, K., and Froyd, J. (2007). Diversifying the U.S. Engineering Workforce: A New Model, *Journal of Engineering Education, 96*(1), 19–32. doi: 10.1002/j.2168-9830.2007.tb00912.x
29. Froyd, J., and Ohland, M. (2005). Integrated Engineering Curricula, *Journal of Engineering Education, 94*(1), 147–164
30. Clark, M.C., Froyd, J., Merton, P., Richardson, J. (2004). The Evolution of Curricular Change Models Within the Foundation Coalition. *Journal of Engineering Education, 93*(1), 37-47
31. Fournier-Bonilla, S. D., Watson, K., Malavé, C., and Froyd, J. (2001). Managing Curricula Change in Engineering at Texas A&M University. *International Journal of Engineering Education, 17*(3), 222-235
32. Al-Holou, N., Bilgutay, N. M., Corleto, C., Demel, J. T., Felder, R., Frair, K., Froyd, J., Hoit, M., Morgan, J., Wells, D.L. (1999). First-Year Integrated Curricula: Design Alternatives and Examples. *Journal of Engineering Education, 88*(4), 435-448. doi: 10.1002/j.2168-9830.1999.tb00471.x
33. Cordes, D., Evans, D.L., Frair, K., and Froyd, J. (1999). The NSF Foundation Coalition: The First Five Years. *Journal of Engineering Education, 88*(1), 73-77. doi: 10.1002/j.2168-9830.1999.tb00414.x

Honors and Awards

- 2015 Distinguished Member Award, IEEE Education Society
- 2012 ASEE Fellow
- 2012 IEEE Fellow
- 2011 Benjamin Dasher Award, Best Paper, Frontiers in Education Conference
- 1998 Ten Best Papers Award, Frontiers in Education Conference
- 1997 Hesburgh Award Certificate of Excellent for the Integrated First-year Curriculum in Science, Engineering and Mathematics, Rose-Hulman Institute of Technology
- 1985 Dean's Outstanding Teaching Award, Rose-Hulman Institute of Technology

Inter-institutional collaborations

- Western Michigan University, University of Iowa (co-author, co-PI)
- University of Texas at Austin, Clemson University (co-author, co-PI)
- Virginia Polytechnic Institute and State University, Bucknell University (co-author, co-PI)
- University of Alabama, Arizona State University, Texas A&M University Kingsville, University of Wisconsin, Rose-Hulman Institute of Technology (co-author, co-PI)

DAVID A. DELAINE, Ph.D.

Assistant Professor
Department of Engineering Education
The Ohio State University, 244 Hitchcock Hall, 2070 Neil Ave., Columbus Ohio 43210
E-mail: Delaine.4@osu.edu

Education

Ph.D. Electrical Engineering, 2012, Drexel University, Philadelphia, PA
B.S. Electrical Engineering, 2005, Northeastern University, Boston, MA

Employment History

- *Vice President for Diversity & Inclusion* October 2013 - October 2017
  International Federation of Engineering Education Societies (IFEES)
- *Postdoctoral Fellow* Escola Politécnica, Universidade de São Paulo July 2013 - March 2016
  Poli-Edu - Research Group in Engineering Education

Graduate Student Advising

- Thesis Committee Member for 2 Ph.D. and 1 Masters Dissertation defense at the Universidade de São Paulo – Escola Politécnica

Courses Taught

1. Introduction to Engineering
2. Math Practicum – Calculus for Engineers
3. Linear Algebra

Publications (Summary):

- Peer-reviewed journal articles: 4
- Proceedings and abstracts: 22 (17 peer-reviewed)
- Bulletins, tech reports, and fact sheets: 2

Selected recent publications (Engineering education related):

1. **D. Delaine**, D. Williams, R. Tull, R. Sigamoney. "Global Diversity and Inclusion in Engineering Education: Developing platforms towards increased international collaboration."*Internationa*l *Journal of Engineering Pedagogy.*
2. **D. Delaine**, D. Williams, R. Tull, R. Sigamoney. "Global Diversity in Engineering Education: An Exploratory Analysis." Proceedings of the 2015 World Engineering Education Forum, Florence, Italy, 2015
3. **D. Delaine,** L. Yanaze, et al. "Perfil dos ingressantes em engenharia na escola politécnica da USP, utilizando a FUVEST 2015 como processo de ingress." Proceedings of the XLII Congresso Brasileiro de Educação 2015, September, 2015.
4. **D. Delaine**, J.R. Cardoso, J. Walther. "Qualitative Analysis of Boundary Spanning Implications within Interviews of Engagement Stakeholders." Proceedings of the 122nd ASEE Annual Conference and Exposition, Seattle, Washington, June 14 – 17, 2015.
5. **D. Delaine**, J.R. Cardoso, J. Walther. "A Boundary Spanner Intervention for Increasing Community Engagement Outcomes – Phase 1: Framing Case Studies in Context." Proceedings of the World Engineering Education Forum 2014, Dubai, United Arab Emirates.
6. **D. Delaine**, et. al. "Comunidade de especialistas como referência para superar os desafios acadêmicos na criação de um grupo de pesquisas em educação em engenharia." Proceedings of the XLII Congresso Brasileiro de Educação 2014.

7. D. Hansberry, **D. Delaine**, D. McEachron, E. Papazoglou, F. Allen, "Who are our students: A multiassesment approach to categorizing an undergraduate biomedical engineering student population". Proceedings of the 9th Annual LACCEI Conference, Medellin, Colombia, August 2011.
8. D. McEachron, E. Papazoglou, F. Allen, **D. Delaine**, D. Hansberry, M. Sualp. "Engineering Education in Context: An Evidence Based Evaluation System", ASEE Global Colloquium on Engineering Education, Singapore, Singapore, October 2010.
9. J. O'Shea, **D. Delaine**, "The Rise of Student-to-Student Learning – Youth-led Programs Impacting Engineering Education Globally", *Proceedings of the IEEE Educon 2011*. Amman, Jordan, 04-06 April, 2011.
10. J. O'Shea, **D. Delaine**, J. DeBoer "Developing Leadership Skills Through Student-Led Initiatives: Student Platform for Engineering Education Development", SEFI 2010 Annual Conference.
11. D. McEachron, F. Allen, G. Papazoglou, **D. Delaine**, "Engineering Education in Context: An Evidence-Based Intervention System" *Proceedings of the 2010 ASEE Annual Conference and Exposition*, Louisville, Kentucky, 2010.
12. **D. Delaine** et. Al, "Student involvement as a vehicle for empowerment: a case study of the student platform for engineering education development", *European Journal of Engineering Education* – Special Issue: Best Papers from the SEFI 37th annual conference 2009*,* Vol. 35, Issue 4, 2010.
13. **D. Delaine** et al. "The Student Platform for Engineering Education Development (SPEED) Empowering the Global Engineer" SEFI Annual Conference, Rotterdam, Netherlands, August 2009. Nominated – Best Paper Award.
14. A. Fox, **D. Delaine**, A.K. Fontecchio, "Development of Non-Traditional Skills in Graduate Students Through Teaching and Curriculum Design", *Proceedings of the 2009 ASEE Annual Conference and Exposition*, Austin, Texas, 2009.
15. **D. Delaine**, A. K. Fontecchio, "Social Networking Websites for Increased Success in Minority Science and Engineering Programs", Proceedings of the 2009 ASEE Annual Conference and Exposition, Austin, Texas, 2009.
16. **D. Delaine**, L. Emelle, et al., "Student Run Outreach Programs for Professional Development and Increased Pre- Collegiate Participation", Proceedings of the 7th ASEE Global Colloquium on Engineering Education, Cape Town, South Africa, 2008.
17. H. J. Shah, **D. Delaine**, and A. K. Fontecchio, "Plasma Modification of Fluoropolymers for Aligning Liquid Crystals", *J. Display Technology* Volume 4, Issue 2, June 2008.
18. H. J. Shah, **D. Delaine**, and A. K. Fontecchio, "Liquid Crystal Alignment on Corona Patterned Polymer Films", *J. Display Technology*. 15(8), 579, 2007.

Honors and Awards

- Postdoctoral Fellowship - Fundação de amparo à pesquisa do estado de são paulo (FAPESP)
- Fulbright scholar award postdoctoral fellowship – awarded fellowship for "assessing the impact of one boundary spanner on university-wide stem educational engagement" at the university of São Paulo.
- National Science Foundation Graduate Reasearch Fellow
- National Science Foundation Bridge to the Doctorate Fellow.
- Ralph J. Bunche scholar throughout undergraduate education.

Inter-Institutional Collaborations

- University of Georgia Collaborative Lounge for Understanding Society and Technology (CLUSTER)
- Poli-Edu – Research Group in Engineering Education, Universidade de São Paulo Escola Politécnica
- The International Federation of Engineering Education Societies
- UNESCO Engineering Programme
- The University of Maryland Baltimore County and the Greater Philadelphia Region Louis Stokes Alliances for Minority Participation

Emily Dringenberg, Ph.D.

Assistant Professor
Department of Engineering Education
The Ohio State University, Hitchcock Hall, 2070 Neil Ave., Columbus, Ohio 43210-1057
E-mail: dringenberg.1@osu

Education

Ph.D. Engineering Education, 2015. Purdue University, West Lafayette, IN.
M.S. Industrial Engineering, 2014. Purdue University, West Lafayette, IN.
B.S. Mechanical Engineering, 2008. Kansas State University, Manhattan, KS.

Employment History

Assistant Professor, Department of Engineering Education, The Ohio State University, Columbus, OH (2017-present).
Teaching Assistant Professor, General Engineering, Kansas State University, Manhattan, KS (2016-2017).
Instructor, General Engineering, Kansas State University, Manhattan, KS (2015-2016).
NSF Graduate Research Fellow, Engineering Education, Purdue University, West Lafayette, IN (2012-2015)
Graduate Professional Assistant, Women in Engineering, Purdue University, West Lafayette, IN (2011-2012)
High School Teacher, Engineering and Mathematics, Grady HS, Atlanta, GA (2009-2011)

Courses Taught at Kansas State University (KSU), Manhattan, KS

1. Engineering Orientation (DEN 160)
2. Engineering Problem Solving (DEN 161)
3. Engineering Decision Making (DEN 301)

Graduate student advising:

- Masters students advised: 1 graduated (Mechanical Engineering)

Publications (Summary):

- Peer-reviewed journal articles: 1
- Peer Reviewed proceedings and abstracts: 10
- Chapters in edited books: 1

Publications

Fila, N. D., Hess, J. L., Purzer, Ş., & **Dringenberg, E**. (2016). Engineering Students' Utilization of Empathy during a Non-Immersive Conceptual Design Task. *International Journal of Engineering Education, 32(3B)*.

Purzer, Ş., Moore, T. J., Dringenberg, E. (In press). Cognition and engineering: Learning transfer and knowledge building. In Y. J. Dori & D. Baker (Eds.), Cognition, metacognition, and culture in STEM education. Springer.

Vesper, M., **Dringenberg, E.** (2016). The Implementation and Preliminary Impact of Intrusive Advising and an Academic Peer-Mentoring Program for Engineering Students. *Proceedings of the American Society for Engineering Education Midwest Regional Conference, Manhattan, KS*.

Dringenberg, E., Wertz, R. E. H. (2016). Work in Progress: How Do First-Year Engineering Students Experience Ambiguity in Engineering Design Problems: The Development of a Self-Report Instrument. *Proceedings of the American Society for Engineering Education Annual Conference and Exposition, New Orleans, LA*.

Dringenberg, E., Mendoza-Garcia, J. A., Tafur, M., Hsu, M., Fila, N. (2015). Using Phenomenography: What are Key Considerations when Selecting a Specific Research Approach? *Proceedings of the American Society for Engineering Education Annual Conference and Exposition, Seattle, WA*.

Chua, M., **Dringenberg, E.** (2014). Work In Progress: The Quest for the Mythical Phoenix: Attendee Narratives at an Engineering Education Faculty Workshop. *Proceedings of the Frontiers in Education Annual Conference, Madrid, Spain*.

Dringenberg, E., Chua, M. (2014). What Can Reflections From an "Innovation in Engineering Education" Workshop Teach Workshop Designers and New Faculty? *Proceedings of the American Society for Engineering Education Annual Conference and Exposition, Indianapolis, IN*.

Dringenberg, E. (2014). First Year Students' Understanding of Normal Distributions: A Preliminary Study of Previous Exposure, Self-Efficacy and Content Knowledge. *Proceedings of the American Society for Engineering Education IL-IN Regional Conference, Terre Haute, IN*.

Denick, D., **Dringenberg, E.,** Fayyaz, F., Nelson, L., Pitterson, N., Tolbert, D., Yatchmeneff, M., Cardella, M. (2013). STEM Thinking in Informal Environments: Integration and Recommendations for Formal Settings. In Proceedings of the *American Society for Engineering Education IL-IN Regional Conference*, *Angola, IN*.

Dringenberg, E., Wertz, R. E. H., Purzer, Ş., & Strobel, J. (2012). Development of the Science and Engineering Classroom Learning Observation Protocol. In Proceedings of the *American Society for Engineering Education Annual Conference and Exposition*, *San Antonio, TX*.

Dringenberg, E., Wiener, J., Purzer, Ş., Groh, J. (2012). Measuring the impact of engineering outreach on middle school students' perceptions. In Proceedings of the *American Society for Engineering Education IL-IN Regional Conference*. *Valparaiso, IN*.

Mondisa, J., Fila, N., **Dringenberg, E**., Zephirin, T. (2012). Work in Progress: A Case Study of the Types and Frequencies of Conflict in Engineering Design Dyads. *In Proceedings of the Frontiers in Education Annual Conference, Seattle, WA*.

Invited Talks

Mestrovich Seay, A., **Dringenberg, E.** (February 8, 2017) Implicit Bias & De-biasing Strategies in Action. Professional development for K-State Research and Extension Agents. Kansas State University. Manhattan, KS.

Dringenberg, E., Baird, C., Tuttle, T. (October 24, 2016) Implicit Bias Panel. Guest panel for Caterpillar Inc. employees. Caterpillar Work Tools. Wamego, KS.

Dringenberg, E., Betz, A. (June 3, 2016) Growth Mindset: How do your perceptions of intelligence help or hinder the teaching and learning environments that you create? Closing Plenary Session. Big XII Teaching and Learning Conference. Manhattan, KS**.**

Dringenberg, E. (February, 2016) Introduction to Implicit Bias. Guest lecture for the K-State Office for the Advancement of Women in Science and Engineering. Manhattan, KS.

Dringenberg, E. (October, 2015) Recognizing Patterns in Gender Bias. Women in Engineering seminar at Kansas State University. Manhattan, KS.

Honors and Awards

- Kansas State University Peer Review of Teaching Fellow, Mentor (2016, 2017)
- ASEE Midwest Section Best Paper (2016)
- K-State Faculty of the Month Nominee (2015) Fall 2015
- National Science Foundation Graduate Research Fellow (2011) Spring 2012
- AmeriCorps Academic Award, Teach For America Service Completion (2011) Spring 2011
- Teach for America Fellow, top 10% of 35,000 applicants nationwide (2009) Fall 2009
- "Outstanding Senior," selected by KSU Mechanical Engineering Faculty (2008) Fall 2008
- FE (Fundamentals of Engineering) Certification (2008) Fall 2008

Deborah M. Grzybowski, Ph.D.

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Education

Ph.D. Biomedical Engineering, 2000. The Ohio State University, Columbus, OH.
M.S. Chemical Engineering, 1982. The Ohio State University, Columbus, OH.
B.S. Chemical Engineering, 1979. The Ohio State University, Columbus, OH.

Employment History

Associate Professor Clinical, Department of Engineering Education, The Ohio State University, Columbus, OH (2016-present).
Associate Professor Clinical, Department of Chemical and Biomolecular Engineering (CBE), The Ohio State University, Columbus, OH (2012-present).
Scientific Advisor, Executive Board of Directors member, The Ohio Lions Eye Research Foundation, Columbus, OH (2011-present).
Assistant Professor Clinical, Engineering Education Innovation Center, College of Engineering, The Ohio State University, Columbus, OH (2012-2015).
Assistant Professor, The Department of Ophthalmology, The Ohio State University, College of Medicine, Columbus, OH (2003-2012*)*.
Director Ohio Lions Eye Research Facility, The Department of Ophthalmology, The Ohio State University, College of Medicine, Columbus, OH (2003-2012*)*.
Research Scientist, The Department of Ophthalmology, The Ohio State University, College of Medicine, Columbus, OH (2002-2003*)*.
Post-Doctoral Fellow, The Department of Biomedical Engineering, The Ohio State University, College of Engineering, Columbus, OH (2000-2002*)*.
French Fellow, Department of Engineering Graphics, The Ohio State University, College of Engineering, Columbus, OH (1992-1999*)*.
Principal Research Scientist, Battelle Memorial Institute, Columbus, OH (1982-1992).

Courses Taught at the Ohio State University (OSU), Columbus, Ohio

1. Fundamentals of Engineering II for Honors – Robot Option (ENGR 1282.01H)
2. Fundamentals of Engineering II for Honors – Nanotechnology Option (Course Director) (ENGR 1282.02H)
3. Bio-Engineering for students with Visual Impairments I (Developed Course) (EDUTL 5992)
4. Fundamentals of Engineering I for Honors (ENGR 1281.01H)
5. Bio-Engineering for students with Visual Impairments II (Developed Course) (EDUTL 5992)
6. Engineering Fundamental and Laboratory I for Honors (ENGR 191)
7. Engineering Fundamental and Laboratory II for Honors (ENGR 192)
8. Introduction to Engineering I (ENGR 181)
9. Graphics 167 MATLAB (ENGR 167)
10. Engineering Fundamental and Laboratory III for Honors – Robot Option (ENGR 193, previously ENGR 168)
11. Engineering Fundamental and Laboratory III for Honors - Nanotechnology Option (ENGR 193A)

Graduate student advising:

- PhD students advised: 3 graduated (2 BME, 1 CBE)
- Masters students advised: 2 graduated (2 BME)
- Post-Doctoral students advised: 2
- Medical Student research programs advised: 52
- Ophthalmology Resident student research programs advised: 26
- Undergraduate Research programs advised: 24

Graduate Student Committees:

- PhD students: 1 graduated (CEGE), 1 current (CEGE)
- Masters students: 2 graduated (CEGE)
- Undergrad Honors Thesis: 1 graduated (BME)

Publications (Summary):

- Peer-reviewed journal articles: 19
- Proceedings and abstracts: 115 (115 peer-reviewed)
- Chapters in edited books: 2
- Bulletins, tech reports, and fact sheets: 2
- Invited speaker at workshops, conferences, and symposiums: 26

Selected recent publications (Engineering education related):

1. Wild, T., **Grzybowski, D.M**., Yang, S.J., Upton, J. "Engineering Education for Teachers of Students with Visual Impairment Professional Development Program", J. Visual Impairment & Blindness, in review.

2. Dixon, K., **Grzybowski, D.M**., Le, J.V., Castro, C.E. "Engaging Adolescent Girls in Engineering by Integrating Visual Art into DNA Origami Content", Journal of Engineering Education, in review.

3. Dixon, K., Barton, M., Le, J.V., Castro, C.E., Richardson, O.R., **Grzybowski, D.M**. "Making Meaning through Art-Integrated Engineering." 2017 American Society for Engineering Education Annual Conference, Columbus, OH, June 2017.

4. **Grzybowski, D.M**., Wild, T., Yang, S.J. "Engineering Education for Students with Visual Impairments." 2017 American Society for Engineering Education Annual Conference, Columbus, OH, June 2017.

5. Wild, T., **Grzybowski, D.M**., Yang, S.J. "EEVI: Engineering Education for Students with Visual Impairments." Council for Exceptional Children, Boston, MA, April 20, 2017.

6. **Grzybowski, D.M**., Wild, T. "EEVI: Engineering Education for Students with Visual Impairments." National Science Teachers Association, Columbus, OH, December 1, 2016.

7. Bannerman, R., Theiss, A. & **Grzybowski, D.M.** "MAKER: Utilizing 3D Printing of Nanotechnology Design Project Prototypes to Enhance Undergraduate Learning." 2016 American Society for Engineering Education Annual Conference, New Orleans, LA, June 2016.

8. Dixon, K. & **Grzybowski, D.M.** "Design as the Practice of Probability: Engaging Adolescent Girls in Art-Infused Engineering." 2016 American Society for Engineering Education Annual Conference, New Orleans, LA, June 2016.

9. Cohen, W., Freuler, R.J., & **Grzybowski, D.M.** "MAKER: Applications of 3D Printing and Laser Cutting in Development of Autonomous Robotics." 2016 American Society for Engineering Education Annual Conference, New Orleans, LA, June 2016.

10. **Grzybowski, D.M.** and J.T. Demel. "Assessment of Inverted Classroom Success Based on Felder's Index of Learning Styles." 2015 American Society for Engineering Education Annual Conference, Seattle, WA, June 2015.

11. **Grzybowski, D.M.**, Stavrdis, O., Sorby, S.A., Merrill, J., Thomas, J.G., Barclay, L., Abrams, L. "Impact of Optional Supplemental Course to Enhance Spatial Visualization Skills in First-Year Engineering Students." 2014 American Society for Engineering Education Annual Conference, Indianapolis, IN, June 2014.

12. Spang, M.T., **Grzybowski, D.M.**, Strickland, A. A. "Works in Progress: Impact of First-Year Micro-/Nano-Technology Research Project Course on Future Research and Graduate/Professional School Involvement." 2014 American Society for Engineering Education Annual Conference, Indianapolis, IN, June 2014.

13. Kecskemety, K., **Grzybowski, D.M.** "Student Perceptions of Inverted Classroom Benefits in a First-Year Engineering Course." 2014 American Society for Engineering Education Annual Conference, Indianapolis, IN, June 2014.

14. Hird, N.L. and **Grzybowski, D.M.** "Impact of Computational Fluid Dynamics use in a First-Year Engineering Research Design Project on Future Performance in Fluid Mechanics." 2014 American Society for Engineering Education Annual Conference, Indianapolis, IN, June 2014.

15. Harper, K.A., Baker, G.R, and **Grzybowski, D.M.** "First Steps in Strengthening the Connections Between Mathematics and Engineering." 2013 American Society for Engineering Education Annual Conference, Atlanta, GA, June 25, 2013.

16. Tague, J., Czocher, J.A., Baker, G.R., Harper, K.A., **Grzybowski, D.M.**, and Freuler, R. "Engineering Faculty Perspectives on Mathematical Preparation of Students." International Conference on Engineering Education and Research 2013, Marrakech, Morocco, July 2013.

17. **Grzybowski, D.M.**, Abernathy, S., Boyd, A.C., Cain, D., Hird, N.L., Madhavan, R.R., Shi, Y., Spang, M.T., Strickland, A.A., and Clingan, P.A. "Student Assisted Approach to Curriculum Changes to Facilitate a Flipped Classroom for First-Year Engineering Micro-/Nano-technology 'Lab-on-a-chip' Research Project." International Conference on Engineering Education and Research 2013, Marrakech, Morocco, July 2013.

Honors and Awards

- Recipient Sphinx/Mortar Board Faculty Award (2014)
- STEP Faculty Member (2013 – present)
- Recipient of Faculty Award for Outstanding Commitment to Student Education, Panhellenic Association (2012)
- Member Executive Board, Scientific Advisor, The Ohio Lions Eye Research Foundation (2011 – present)
- ISTAART ICAD Travel Fellowship (2008)
- Society for Research in Hydrocephalus and Spinal Bifida Travel Award (2008)
- Intracranial Hypertension Research Foundation Scientific Advisory Panel (2006 – present)
- The BrainChild Steering Committee (2006 – present)
- Recipient Landacre Faculty Teaching Award (2005)
- Association for Research in Vision and Ophthalmology Travel Award (2004)
- CIC Women in Science and Engineering Travel Grant (1998)
- French Fellowship Recipient (1992 – 1999)
- Graduate Fellow; Tau Beta Pi; Sigma Delta Epsilon; Texnikoi; Outstanding Senior in Chemical Engineering Award, The American Institute of Chemists; Outstanding Freshman Award, Outstanding Freshman Chemistry Award, CRC. (1976-1982)

Panel Member

- NSF Biomedical Engineering Panel 2013 & 2014 NSF Graduate Research Fellowship Program (GRFP)
- National Sciences and Engineering Research Council of Canada, Collaborative Health Research Projects, 2011.
- Alzheimer's Association, 2009, 2010, 2011
- NIH Neurotransporters, Receptors, Channels, and Calcium Signaling Study Section; 2/2011
- NIH ZRG1 ETTN-K (10) B - Small Business: Clinical Neurophysiology, Devices, Auditory Devices and Neuroprosthesis; 10/2011

Selected Sponsored Research (Approximate Total Funding Received $1,290,000)

1. "Engineering Education for Students with Visual Impairments (EEVI) Project," Principal Investigator, Ohio Department of Education, MSP Program, $593,193; 2015-2017.
2. "smART::ART Integrated Formal and Informal STEM Education," Principal Investigator, OSU Engagement Impact Grant, $45,000; 2015-2017.
3. "smART: Spatial Visualization and Creativity in Middle School Engineering," Co-Investigator, Battelle Community STEM Challenge Grant, $53,000; 2015-2017.
4. "1282.02H OSU Library Course Enhancement Grant," Principal Investigator, $2,000; 2012-2013.

Inter-institutional collaborations

- Manchester University (co-author)
- Brown University (co-author)
- Duke University (co-author, co-PI)
- ETH Zurich (co-author)

APPENDIX 2a: Program Goals, Learning Outcomes, and Levels of Proficiency

Table 1. Goal #1 with Program Outcomes and Levels of Proficiency

Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
1. Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs	1.A. Engage critical issues in the field with attention to inclusion of multiple perspectives and demographics	1.A.(B) Identify several of the contemporary educational issues with attention to inclusion of multiple perspectives and demographics
		1.A.(I) Discuss the main perspectives of contemporary educational issues and describe impact on stakeholders with attention to inclusion of multiple perspectives and demographics.
		1.A.(A) Develop and execute a plan to address educational issues with attention to inclusion of multiple perspectives and demographics
	1.B. Analyze the history and foundations of the education of engineers and the discipline of engineering education in US and international contexts	1.B.(B) Identify broad historical and foundational aspects of engineering education in US and international contexts.
		1.B.(I) Discuss key historical and foundational aspects of engineering education related to conte mporary issues in US and international contexts.
		1.B.(A) Synthesize relevant educational history and foundations of critical contemporary issues in US and international contexts.
	1.C. Characterize potential stakeholders and design appropriate engagement strategies	1.C.(B) Identify primary stakeholders of engineering education.
		1.C.(I) Explain relationships among stakeholders and contemporary educational issues.
		1.C.(A) Define appropriate engagement strategies with stakeholders.
	1.D. Identify and interpret stakeholder needs to develop action plans	1.D.(B) Describe several relevant stakeholder needs.
		1.D.(I) Interpret stakeholder needs in relationship to engineering education.
		1.D.(A) Create an action plan to address one or more stakeholder needs.
	1.E. Contribute to high-impact efforts to use and/or transform engineering education to best meet stakeholder needs	1.E.(B) Actively participate in an effort that leads to specific application or transformation of engineering education to meet stakeholder needs.
		1.E.(I) Lead an effort grounded in theory of change to transform engineering education to best meet stakeholder needs.
		1.E.(A) Translate high-impact effort into scholarship.

Table 2. Goal #2 with Program Outcomes and Levels of Proficiency

Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
2. Design, conduct, and critique research in engineering education	2.A. Research with attention to inclusion of multiple perspectives and demographics so that research outcomes are more universally relevant	2.A.(B) Identify ways that diverse populations may be impacted negatively and positively by research.
		2.A.(I) Reflect critically on research across various fields that targets diverse audiences.
		2.A.(A) Expand the body of knowledge in engineering education with attention to inclusion of multiple perspectives and demographics.
	2.B. Demonstrate awareness of broadly applicable research opportunities, funding, resources, and communications (internal and external to the field)	2.B.(B) Identify current research opportunities and communications within and outside of engineering education.
		2.B.(I) Distinguish between types of resources and funding available and the corresponding reporting expectations.
		2.B.(A) Select appropriate research opportunities, funding, resources, and communications that aligns with one's research interests and expertise.
	2.C. Construct appropriate research questions in engineering education that address stakeholder needs and advance the field	2.C.(B) Identify appropriate, researchable questions considering relevant literature that address stakeholder needs and advance the field.
		2.C.(I) Appraise whether research questions appropriately align with an overall research study design, address stakeholder needs, and advance the field and contributes to larger body of knowledge in engineering education.
		2.C.(A) Develop sound engineering education research questions that address stakeholder needs and advance the field.
	2.D. Design research that uses appropriate and evidence-based methods	2.D.(B) Define qualitative, quantitative, and mixed methods commonly used within and outside of engineering education research.
		2.D.(I) Select appropriate methods to research questions.
		2.D.(A) Propose a comprehensive research project that uses a sound methodological design.
	2.E. Collect, analyze, and interpret data using appropriate techniques	2.E.(B) Collect, analyze, and interpret data within a given set of research parameters
		2.E.(I) Collect, analyze, and interpret data for a comprehensive research project
		2.E.(A) Defend the collection, analysis, and interpretation of data from a comprehensive research project

Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
2. Design, conduct, and critique research in engineering education *(continued)*	2.F. Communicate results of research efforts in traditional and non-traditional forms	2.F.(B) Differentiate among and select types of dissemination venues for research.
		2.F.(I) Assess when research is appropriate for submission to identified venues.
		2.F.(A) Publish in a peer-reviewed dissemination outlet.
	2.G. Critique the quality of engineering education research studies of various types presented in different forms	2.G.(B) Identify quality indicators of research.
		2.G.(I) Evaluate the quality of a selected scholarly effort.
		2.G.(A) Serve as a peer reviewer of research studies for an appropriate dissemination venue.
	2.H. Analyze how a broad array of research projects integrate into the field.	2.H.(B) Recognize prior research conducted in an area of interest.
		2..H.(I) Determine how to make connections across research themes to identify gaps in literature.
		2.H.(A) Propose a research agenda informed from a synthesis of existing literature and research across multiple fields.
	2.I Structure, manage, and implement research projects.	2.I.(B) Define the aspects of research project management.
		2.I.(I) Develop a structured plan to manage a research study for implementation.
		2.I.(A) Execute a research project and reflect on the execution of that project.

Table 3. Goal #3 with Program Outcomes and Levels of Proficiency

Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
3. Demonstrate, value, and apply engineering expertise	3.A. Apply an engineering mindset to devise solutions to complex problems with attention to inclusion of multiple perspectives and demographics.	3.A.(B) Discuss solutions to complex problems with attention to inclusion of multiple perspectives and demographics.
		3.A.(I) Discern the impact of engineering solutions with attention to inclusion of multiple perspectives and demographics.
		3.A.(A) Develop an engineering solution to a complex problem with attention to inclusion of multiple perspectives and demographics.
	3.B. Demonstrate engineering competence in at least one specific domain.	3.B.(B) Define an engineering problem and discuss multiple solutions within selected domain
		3.B.(I) Assess integrity of an engineering solution using design criteria within a selected domain
		3.B.(A) Create and validate an engineering solution within selected domain
	3.C. Formulate applications of engineering education to engineering practice and vice versa.	3.C.(B) Discuss a novel solution and translate language to and from engineering and engineering education settings
		3.C.(I) Design and propose a novel solution to and from engineering and engineering education settings
		3.C.(A) Synthesize outcomes from an engineering solution into an engineering education setting and vice versa
	3.D. Identify pathways for lifelong learning in engineering.	3.D.(B) Discuss opportunities for continued learning in engineering.
		3.D.(I) Propose a professional development agenda illustrating pathways for lifelong learning in engineering.
		3.D.(A) Demonstrate engagement within opportunities for lifelong learning in engineering.

Table 4. Goal #4 with Program Outcomes and Levels of Proficiency

Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
4. Create, teach, and assess courses and curricula	4.A. Educate with attention to inclusion of multiple perspectives and demographics so that every student has the opportunity to learn	4.A.(B) Discuss student and teacher similarities and differences across multiple perspectives and demographics
		4.A.(I) Experiment with different teaching techniques to engage multiple perspectives and demographics so that every student has the opportunity to learn
		4.A.(A) Engage all students in a given educational experience so that every student has the opportunity to learn.
	4.B. Design a course or other significant educational experience founded in learning theory explicitly addressing stakeholder needs	4.B.(B) Build a lesson plan addressing stakeholder needs.
		4.B.(I) Critique an existing course syllabus using learning theory.
		4.B.(A) Develop a course syllabus and discuss the choices made founded in learning theory explicitly addressing stakeholder needs.
	4.C. Analyze how multiple courses integrate into a curriculum	4.C.(B) Evaluate a course's significance and effectiveness in the context of other courses in a curriculum.
		4.C.(I) Synthesize a set of courses' impact on students' learning across a curriculum.
		4.C.(A) Propose curricular adjustments to address gaps in achieving learning outcomes.
	4.D. Instruct a course or other significant educational experience using appropriate and evidence-based pedagogical techniques	4.D.(B) Observe a course or other significant educational experience, highlighting the various techniques used and their appropriateness to the context.
		4.D.(I) Teach effectively a course or other significant educational experience.
		4.D.(A) Use appropriate and evidence-based pedagogical techniques while teaching a course.

Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
4. Create, teach, and assess courses and curricula *(continued)*	4.E. Assess and improve their own teaching through informed, inquiry-based practice	4.E.(B) Reflect on one's teaching experiences highlighting strengths and areas for improvement
		4.E.(I) Critique different examples of teaching, highlighting the various techniques used and their appropriateness to the context.
		4.E.(A) Gather and apply teaching feedback.
	4.F. Develop effective tools to evaluate learning	4.F.(B) Create appropriate learning outcomes.
		4.F.(I) Develop tools that measure learning outcomes at various levels.
		4.F.(A) Revise tools and learning outcomes based on experiences and student feedback.
	4.G. Evaluate and improve student learning responsibly, equitably, and in alignment with learning outcomes	4.G.(B) Identify students' level of knowledge, skills, and abilities responsibly, equitably, and in alignment with learning outcomes.
		4.G.(I) Determine students' difficulties in alignment with various learning outcomes.
		4.G.(A) Develop responsible and equitable strategies to assist students in their learning that align with learning outcomes
	4.H. Design and implement evaluations/assessments of a variety of educational programming	4.H.(B) Describe the differences and similarities between assessment and evaluation.
		4.H.(I) Critique an educational program using appropriate assessment and evaluation tools.
		4.H.(A) Develop a tool to assess and evaluate the effectiveness of an educational program.

Table 5. Goal #5 with Program Outcomes and Levels of Proficiency

Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
5. Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits	5.A. Engage in professional activities with attention to inclusion of multiple perspectives and demographics in order to create synergy in the midst of differences.	5.A.(B) Reflect with curiosity about what can be learned from communities and cultures with attention to inclusion of multiple perspectives and demographics in order to create synergy in the midst of differences.
		5.A.(I) Demonstrate evidence of adjustment in attitudes and beliefs through working within and learning from diverse communities and cultures.
		5.A.(A) Promote others' engagement with diversity.
	5.B. Demonstrate a mindset that values curiosity and questioning, finds and leverages connections across a wide range of ideas, and creates positive societal value	5.B.(B) Discuss the diverse and rapidly changing world from more than one field of study or perspective with curiosity about potential positive societal values.
		5.B.(I) Connect examples, facts, or theories from more than one field of study or perspective and describe how positive societal value is created.
		5.B.(A) Synthesize conclusions by combining examples, facts, or theories from more than one field of study or perspective which create positive societal value .
	5.C. Function effectively on diverse, multidisciplinary teams	5.C.(B) Discuss the elements of effective teamwork and importance of diverse, multidisciplinary teams.
		5.C.(I) Participate effectively on a diverse, multidisciplinary team.
		5.C.(A) Manage a diverse, multidisciplinary team.
	5.D. Communicate effectively with a range of audiences using multiple modes and media	5.D.(B) Explain the appropriate communication strategies to use with a range of audiences using multiple modes and media.
		5.D.(I) Critique specific communications considering a range of potential audiences.
		5.D.(A) Disseminate/publish appropriate to target audience(s) using multiple modes and media.
	5.E. Recognize, analyze, and equitably engage with professional ethical dilemmas	5.E.(B) Recognize complex, multi-layered professional ethical dilemmas.
		5.E.(I) Critique appropriate perspectives and theories used to analyze professional ethical dilemmas, considering full implications.
		5.E.(A) Apply appropriate perspectives and theories to engage professional ethical dilemmas including assumptions and implications, equitably defending trade-offs.

Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
5. Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits *(continued)*	5.F. Demonstrate effective leadership skills	5.F.(B) Discuss the elements of effective leadership skills, including self-awareness, resource management, and motivating others.
		5.F.(I) Critique leadership skills of select individuals, considering visioning, conflict and resource management, and mentoring.
		5.F.(A) Apply effective leadership skills.
	5.G. Apply appropriate principles to manage teams and projects	5.G.(B) Describe the project management process and primary constraints including scope, schedule, budget, and quality.
		5.G.(I) Critique project management from a variety of sectors including education, development, and industry.
		5.G.(A) Implement the project management process for a comprehensive project
	5.H. Demonstrate empathy and cultural competence across professional interactions	5.H.(B) Identify components of multiple cultural perspectives.
		5.H.(I) Demonstrate empathetic connection to the complexity of elements important to multiple cultures.
		5.H.(A) Promote empathy and cultural competence across professional interactions.
	5.I. Prepare professional documents and demonstrate effective communication skills appropriate to a variety of job search and career advancement processes	5.I.(B) Describe documents prepared regularly in professional career contexts and identify quality indicators of each.
		5.I.(I) Prepare documents and demonstrate effective communication skills appropriate to a variety of job search and career advancement processes .
		5.I.(A) Solicit feedback from multiple sources and revise professional documents appropriate to career goals.
	5.J. Value and demonstrate commitment to continuing education and lifelong learning	5.J.(B) Describe multiple continuing education learning experiences explaining the value of lifelong learning.
		5.J.(I) Develop and pursue plans for lifelong learning to support career goals.
		5.J.(A) Promote and contribute to knowledge and experiences of peers which provide foundation for expanded knowledge, growth, and maturity over time.

Appendix 2b. Curriculum Map for Engineering Education PhD program

Program Goals & corresponding Learning Outcomes		Required Courses							Elective Courses	Co-Curricular Milestones											
														Annual Review							
		6100 Foundations	6200 Learning theory, pedagogy, assessment	7780 Research methods	7189.01 Practicum 1	7981 Seminar	7189.02 Practicum 2	7900 Professional development		Prior learning (admission standards)	Qualifying exam (written and oral)	Engineering portfolio ± MEng or equivalent	Proposal and Candidacy (written and oral)	Teaching opportunities	Specialization	Individual learning research group	Dissertation Research	Dissertation Document	Dissertation Oral Defense
1. Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs	A. Engage critical issues in the field with attention to inclusion of multiple perspectives and demographics	B	B/I	B/I		I		I			I		I			A	A	A	I
	B. Analyze the history and foundations of the education of engineers and the discipline of engineering education in US and international contexts	B/I	B/I			I		I/A			I						A	A	I/A
	C. Characterize potential stakeholders and design appropriate engagement strategies	B/I	B/I			I		B/I/A			I		A			I/A	I/A	I/A	I/A
	D. Identify and interpret stakeholder needs to develop action plans	B/I	B			I		B/I/A					B			I/A	I/A		
	E. Contribute to high impact efforts to use and/or transform engineering education to best meet stakeholder needs			B	B		B						B			I/A	I/A	I/A	I
2. Design, conduct, and critique research in engineering education	A. Research with attention to inclusion of multiple perspectives and demographics so that research outcomes are more universally relevant	B		B/I		I					I		I			I	A	A	A
	B. Demonstrate awareness of broadly applicable research opportunities, funding, resources, and communications (internal and external to the field)			B		B		I/A					A			I/A			
	C. Construct appropriate research questions in engineering education that address stakeholder needs and advance the field	B		B/I/A		I					I/A		A			A	A	A	A
	D. Design research that uses appropriate and evidence-based methods			B/I							I		A			I/A	A	A	A
	E. Collect, analyze, and interpret data using appropriate techniques			B							I		I			A	A	A	A
	F. Communicate results of research efforts in traditional and non-traditional forms	B		B				B					B/I			I/A	I/A	A	A
	G. Critique the quality of engineering education research studies of various types presented in different forms	B/I	B/I	B/I		I					I		I		A	I			
	H. Analyze how a broad array of research projects integrate into the field.	B		B		I		A					I			B/I	A	A	I
	I. Structure, manage, and implement research projects			B/I									I			B/I/A	A	A	A
3. Demonstrate, value, and apply engineering expertise	A. Apply an engineering mindset to devise solutions to complex problems with attention to inclusion of multiple perspectives and demographics.									B/I		B/I/A							
	B. Demonstrate engineering competence in at least one specific domain.									B/I		B/I/A							
	C. Formulate applications of engineering education to engineering practice and vice versa.		B/I		B		I							I/A		B	I/A	I/A	I/A
	D. Identify pathways for lifelong learning in engineering.							I/A		B		B/I				B			

NOTES: Letter (B, I, A) indicates level of highest proficiency attainment in that course or curricular element:
"B" = BASIC skills encompassing knowledge and comprehension of subject matter
"I" = INTERMEDIATE skills encompassing application of knowledge to analyze a problem
"A" = ADVANCED skills encompassing ability to evaluate, judge, and synthesize information

Program Goals & corresponding Learning Outcomes		Required Courses							Elective Courses	Co-Curricular Milestones									
														Annual Review					
		6100 Foundations	6200 Learning theory, pedagogy, assessment	7700 Research methods	7189.01 Practicum 1	7881 Seminar	7189.02 Practicum 2	7900 Professional development		Prior learning (admission standards)	Qualifying exam (written and oral)	Engineering portfolio ± eMEng or equivalent	Proposal and Candidacy (written and oral)	Teaching opportunities	Specialization	Individual learning research group	Dissertation Research	Dissertation Document	Dissertation Oral Defense
4. Create, teach, and assess courses and curricula	A. Educate with attention to inclusion of multiple perspectives and demographics so that every student has the opportunity to learn		B/I		A		A				B			I/A					
	B. Design a course or other significant educational experience founded in learning theory explicitly addressing stakeholder needs		I/A		B		I				I			I/A					
	C. Analyze how multiple courses integrate into a curriculum		B/I/A		B		A								B/A				
	D. Instruct a course or other significant educational experience using appropriate and evidence-based pedagogical techniques		B		I/A		A							I/A					
	E. Assess and improve their own teaching through informed, inquiry-based practice		B/I		B/I		A							B/I/A					
	F. Develop effective tools to evaluate learning		B/I		I		A				B/I			I/A					
	G. Evaluate and improve student learning responsibly, equitably, and in alignment with learning outcomes				B/I		I/A							B/I/A					
	H. Design and implement evaluation/assessments of a variety of educational programming		B/I		B		I/A				I								
5. Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits	A. Engage in professional activities with attention to inclusion of multiple perspectives and demographics in order to create synergy in the midst of differences.				B	I	B/I	B						B/I		A	A	A	A
	B. Demonstrate a mindset that values curiosity and questioning, finds and leverages connections across a wide range of ideas, and creates positive societal value	B/I	B/I			A					I	I	A			A	A	A	A
	C. Function effectively on diverse, multidisciplinary teams			B	I		I	B								I/A	A		
	D. Communicate effectively with a range of audiences using multiple modes and media		B/I	B/I		B/I/A		I/A						B		I	A	A	A
	E. Recognize, analyze, and equitably engage with professional ethical dilemmas	B/I	B/I	B		A					I					A	A		A
	F. Demonstrate effective leadership skills				B		I	B/I						A		A	A		
	G. Apply appropriate principles to manage teams and projects			B				B/I								I	A		
	H. Demonstrate empathy and cultural competence across professional interactions	B	B		I		I	A			B		I	I		A	A	A	A
	I. Prepare professional documents and demonstrate effective communication skills appropriate to a variety of job search and career advancement processes					B		B/I/A				I				I/A		A	
	J. Value and demonstrate commitment to continuing education and lifelong learning					B		B/I				I		A		A	I	A	A

NOTES: Letter (B, I, A) indicates level of highest proficiency attainment in that course or curricular element:
"B" = BASIC skills encompassing knowledge and comprehension of subject matter
"I" = INTERMEDIATE skills encompassing application of knowledge to analyze a problem
"A" = ADVANCED skills encompassing ability to evaluate, judge, and synthesize information

APPENDIX 2c. Example semester-by-semester plans for students with and without M.S. engineering degrees at time of admission

Entering with a M.S. in Engineering
(Transfer 12 Engineering Credits)

	Autumn	**Spring**	**Summer**
Year 1	ENGREDU 7881 (1)	ENGREDU 7881 (1)	Diss (6)
	ENGREDU 6100 (3)	ENGREDU 6200 (3)	Elec (3)
	ENGREDU 7780 (3)	Research methods (3)	Qualifying Exam
	ENGREDU 7189.01 (2)	ENGREDU 7189.02 (1)	
		Diss (1)	
	9	**9**	**9**
Year 2	Research methods (3)	ENGREDU 7900 (3)	Diss (6)
	Elec (3)	Research methods (3)	Candidacy
	Elec (3)	Elec (3)	
	Diss (6)	Diss (6)	
	15	**15**	**6**
Year 3	Diss (3)	Diss (3)	
		Defense	
	3	**3**	

Entering with a B.S. in Engineering
(Transfer 0 Credits)

	Autumn	**Spring**	**Summer**
Year 1	ENGREDU 7881 (1)	ENGREDU 7881 (1)	Qualifying Exam
	ENGREDU 6100 (3)	ENGREDU 6200 (3)	
	ENGRED 7780 (3)	Engineering (3)	
	ENGREDU 7189.01 (2)	ENGREDU 7189.02 (1)	
	9	**8**	
Year 2	Research methods (3)	Research methods (3)	Diss (6)
	Engineering (3)	Elec (3)	
	Engineering (3)	Engineering (3)	
	Elec (3)	Diss (1)	
	9	**10**	**6**
Year 3	Elec (3)	ENGREDU 7900 (3)	Diss (6)
	Research methods (3)	Elec (3)	Candidacy
	Diss (6)	Diss (6)	
	12	**12**	**6**
Year 4	Diss (3)	Diss (3)	
		Defense	
	3	**3**	

DEPARTMENT OF ENGINEERING EDUCATION Ph.D. ADVISING SHEET

College of Engineering, The Ohio State University

Name:	**OSU Student ID #:**
Area of Study:	**Admission Year:**
Faculty Advisor:	**Expected Graduation:**

Minimum of 80 Graduate Credit Hours (may include up to 30 hours of transfer credit)

This form must be completed and submitted by the student to EED Graduate Studies Committee with his or her faculty advisor signature before the department can approve the Application to Graduate through the GRADFORMS.OSU.EDU system.

Transfer Credit

*All transfer coursework MUST be approved by student's faculty advisor and have been completed within 6 years of the date of admission. For **OSU Graduate Non-Degree** courses, a limit of 7 semester hours may be transferred. For **non-OSU graduate courses or a completed Master's degree**, a maximum of 30 hours can be transferred. The Transfer of Graduate Credit form must be completed and submitted through the GRADFORMS.OSU.EDU system.*

Institution	Course Number/Title	Date Transfer of Graduate Credit submitted	Units

Professional Engagement

*Each EED doctoral student is expected to complete an **Annual Evaluation** of professional and academic progress with his/her faculty advisor. See the EED Graduate Handbook for the process and expectations regarding student involvement in professional organizations, presentations, conferences, and publications.*

EED Core Ph.D. Requirements

Each EED doctoral student is required to complete the core coursework.

Course #	Course Title	Term/Year	Grade	Unit(s)
ENGREDU 6100	Foundations and the Field of Engineering Education			
ENGREDU 6200	Learning Theory, Pedagogy, and Assessment			
ENGREDU 7780	Engineering Education Research Methods			
ENGREDU 7881	Seminar			
ENGREDU 7900	Professional Development in Engineering Education			

Specialization Elective Courses

*Please refer to the **approved list of elective courses for each EED Specialization.** Other courses within or outside EED must be approved by your faculty advisor*

Course #	Course Title	Term/Year	Grade	Unit(s)

Engineering disciplinary requirement

Each EED doctoral student must complete at least twelve hours of traditional engineering coursework at the graduate (5000+) level.

Course #	Course Title	Term/Year	Grade	Unit(s)

Research Methods

*Each EED doctoral student is required to complete a minimum of 9 semester hours of Research Methods coursework, but faculty advisors may require more. Students may choose a qualitative, quantitative, mixed focus, or other research method approved by their faculty advisor. **ENGEDU 7780 is highly recommended prior to beginning a research sequence.***

Course #	Course Title	Term/Year	Grade	Unit(s)

Scholarly Teaching Practicum

*The purpose of the Scholarly Teaching Practicum course sequence is to provide students with professional experiences of closing the research-practice loop in engineering education. Each doctoral student must complete **a minimum of 3 hours** of ENGREDU 7189. These are distinct from assistantship (i.e. GAA, GTA, or GRA) hours.*

Course #	Course Title	Term/Year	Grade	Unit(s)
ENGREDU 7189.01	Engineering Education Practicum I			
ENGREDU 7189.02	Engineering Education Practicum II			

Candidacy Examination

*Once all of the above course requirements are fulfilled, doctoral students should register for ENGREDU 7193 with his/her faculty advisor for **at least 2 consecutive terms** in preparation for the Candidacy Examination (no minimum number of credits required) and for **at least 3 credit hours of ENGREDU 7193 during the semester in which the candidacy examination is completed.***

Course #	Course Title	Term/Year	Grade	Unit(s)
ENGREDU 7193	Individual Studies in Preparation for Candidacy Exam			
ENGREDU 7193	Individual Studies in Preparation for Candidacy Exam			
ENGREDU 7193	Individual Studies in Preparation for Candidacy Exam			
ENGREDU 7193	Individual Studies Semester of Candidacy Exam			

Minimum of 4 Candidacy Committee Members (Including Faculty Advisor)	Date of Candidacy Exam
1.	
2.	
3.	
4.	

Candidacy & Residency Requirements

Completed	
	Dissertation completed within 5 years of being admitted to candidacy or one-term extension petition has been approved (via *GRADFORMS.OSU.EDU*).
	Minimum of 24 graduate credit hours at OSU.

Dissertation Research

*Each EED doctoral student must complete a minimum of 6 graduate credit hours research post-candidacy with his/her faculty advisor. It is also a requirement to maintain continuous enrollment (AU/SP, SP/SU, or SU/AU) with 3 graduate credit hours per semester. Summer Term (includes May Session and Summer Session) enrollment is excluded **except** for those completing an exam or defense during the Summer.*

Course #	Course Title	Term/Year	Grade	Unit(s)
ENGREDU 8999	Dissertation Research			
ENGREDU 8999	Dissertation Research			
ENGREDU 8999	Dissertation Research			
ENGERDU 8999	Dissertation Research			

Minimum of 3 Dissertation Committee Members (Including Faculty Advisor)	Date of Final Exam
1.	
2.	
3.	
4.	

Student Signature:		**Credit Hour Total (Minimum of 80):**	
Faculty Advisor Signature:			

Appendix 2e: Examples of Engineering Education Doctoral Dissertation Titles from Purdue University and Virginia Tech (2006-2015)

Alum	Grad Year	Dissertation Title
Jennifer Mullin	2010	Investigations of Student and Team Creativity on an Introductory Engineering Design Project
Erin Crede	2011	Organization and Retention of Students in Graduate Engineering Research Groups
James Pembridge	2011	Mentoring in Engineering Capstone Design Courses: Beliefs and Practices across Disciplines
Ken Stanton	2011	Engineering Faculty Motivation for and Engagement in Formative Assessment
William Michael Butler	2012	The Impact of Simulation-Based Learning in Aircraft Design on Aerospace Student Preparedness for Engineering Practice: A Mixed Methods Approach
Parhum Delgoshaei	2012	Design and Implementation of a Real-Time Environmental Monitoring Lab with Applications in Sustainability Education
Andrea Goncher	2012	The Identification and Emergence of Constraints in First-Year Design Projects and the Effect on Practice in Engineering Students
Heidi Steinhauer	2012	Assessment of First-Year Engineering Students' Spatial Visualization Skills
Katherine Winters	2012	Career Goals and Actions of Early Career Engineering Graduates
Matthew Boynton	2013	People not Print: Exploring Engineering Future Possible Self Development in Rural Areas of Tennessee's Cumberland Plateau
Cheryl Carrico	2013	Voices in the Mountains: A Qualitative Study Exploring Factors Influencing Appalachian High School Students' Engineering Career Goals
Stephanie Cutler	2013	How Static is the Statics Classroom? An investigation into how innovations, specifically Research-Based Instructional Strategies, are adopted into the Statics classroom
Rachel Louis Kaifez	2013	The Motivation and Identity Development of Graduate Teaching Assistants in First-Year Engineering Programs
M. Jean Mohammadi-Aragh	2013	Characterizing student attention in technology-infused classroom using real-time active window data
Jacob Moore	2013	Promoting Conceptual Understanding via Adaptive Concept Maps
Lauren Thomas	2013	Preparing and Progressing: A Narrative Study of Optics and Photonics Graduate Students' Identity-Trajectory
Rachel McCord	2014	Thinking About Thinking in Study Groups: Studying Engineering Students' Use of Metacognition in Naturalistic Setting
Kevin Sevilla	2014	Virtual Socialization in Engineering Education: Identifying the Impacts of a Socializer-Based Intervention on Second-Year Engineering Students
Hon Jie Teo	2014	Knowledge Creation Analytics for Online Engineering Learning
Kelly Cross	2015	The Experiences of African-American Males on Multiracial Student Teams in Engineering
Deirdre Hunter	2015	Implementing Problem-based Learning in Introductory Engineering Courses: A Qualitative Investigation of Facilitation Strategies
Walter Lee	2015	Providing Co-Curricular Support: A Multi-Case Study of Engineering Student Support Centers
Courtney S. Smith	2015	The Intersecting Perspective: African American Female Experiences with Faculty Mentoring in Undergraduate Engineering
Chris Venters	2015	Using Writing Assignments to Promote Conceptual Knowledge Development in Engineering Statics

Alum	Grad Year	Dissertation Title
Tamara Moore	2006	Student Team Functioning and the Effect on Problem Solving in a First-Year Engineering Course
Stephanie Kusano		Unknown
Mica Green	2007	Factors Affecting the Self-Efficacy Beliefs of First- and Second-Year Engineering Students
Brock Barry	2008	Methods of Incorporating Understanding of Professional and Ethical Responsibility in the Engineering Curriculum and Results from the Fundamentals of Engineering Examination
Shanna Daly	2008	Design Across Disciplines
Holly Matusovich	2008	Choosing Engineering: Can I Succeed and Do I Want To? A Qualitative Study Using Expectancy-Value Theory
Euridice Oware	2008	Examining Elementary Students' Perceptions of Engineers
Alejandra Magana de Leo	2009	Professors' and students' perceptions and experiences of computational simulations as learning tools
Ken Reid	2009	Development of the Student Attitudinal Success Instrument: Assessment of First-Year Engineering Students Including Differences by Gender
Aidsa Santiago Roman	2009	Fitting Diagnostic Assessment to the Concept Assessment Tool for Statics
Odesma Dalrymple	2009	The Pedagogical Value of Disassemble/Analyze/Assemble (DAA) Activities: Assessing the Potential for Transfer
Matthew Verleger	2009	Analysis of an Informed Peer Review Matching Algorithm and Its Impact on Student work on Model-Eliciting Activities
Kerry Meyers	2009	Engineering Identity as a Developmental Process
Tameka Clarke Douglas	2010	A Case Study of an Undergraduate Engineering Peer Tutoring Group: An Investigation of the Structure of a Community of Practice and the Value Members Gain from Participation
Carla Zoltowski	2010	Students' Ways of Experiencing Human-Centered Design
Nathan McNeill	2010	Global Engineering Education Programs: More than Just International Experiences
Greg Bucks	2010	A Phenomenographic Study of the Ways of Understanding Conditional and Repetition Structures in Computer Programming Languages
Yogesh Velankar	2010	Conceptions of research and development work and competence in a high-tech entrepreneurial organization
Irene Mena	2010	Socialization Experiences Resulting from Engineering Teaching Assistantships at Purdue University
Shawn Jordan	2010	Success in Virtual Cross-disciplinary Engineering Design Teams in Industry
Rocio Chavela	2010	Faculty development units at Mexican higher education institutions: A descriptive study of characteristics, common practices and challenges
Katerina Bagiati	2011	Early Engineering: A Developmentally Appropriate Curriculum for Young Children
Michele Strutz	2012	Influences on Low-SES First Generation Students' Decision to Pursue Engineering
Ida Ngambeki	2012	Finding a Place in Engineering: Examining Students' Choice of Engineering Discipline

Alum	Grad Year	Dissertation Title
Lorie Groll	2013	Negotiating Cultural Humility: First-YearEngineeringStudents'Developmentina Lifelong Journey
Qu Jin	2013	Modeling Student Success in Engineering Education
Sensen Li	2013	Formative feedback using pseudo peer diagrams: Evaluating system equilibrium of buoyancy forces
Mary Pilotte	2013	Engineering: Defining and Differentiating Its Unique Culture
Jiabin Zhu	2013	Personal Epistemological Development of Chinese Engineering Doctoral Students in U.S. Institutions: An Application of Perry's Theory
Diana Bairaktarova	2013	Mechanical Objects and the Engineering Learner: An Experimental Study of How the Presence of Objects Affects Students' Performance on Engineering-Related Tasks
Joe Lin	2013	Student success: Approaches to modeling student matriculation and retention
George Ricco	2013	Degree program changes and curricular flexibility: Addressing long held beliefs about student progression
Junqui Wang	2013	Assessment of Engineering Student Team Effectiveness
Beth Holloway	2013	Engineering students at typically invisible transition points: A focus on admissions and the sophomore year
Daniel Ferguson	2013	How engineering innovators characterize engineering innovativeness: A qualitative study
Ruth Wertz	2014	Toward a new model within the community of inquiry framework: Multivariate linear regression analyses based on graduate student perceptions of learning online
Rui Celia Pan	2014	Engineering Students Experiences and Perceptions of Workplace Problem Solving
Junaid Siddiqui	2014	Transformation of engineering education: Taking a perspective for the challenges of change
James Huff	2014	Psychological Journeys of Engineering Identity from School to the Workplace: How Students Become Engineers Among Other Forms of Self
Meagan Pollack	2014	Multiple Case Study Analysis of Young Women' □ ™s Experiences in High School
Noah Salzman	2014	A Phenomenographic Study of Students' Experiences with Transition from Pre-college Engineering Programs to First-Year Engineering
Anne Lucietto	2014	The Role of Academic Ability in Choice of Major and Persistence in STEM Fields
Velvet Fitzpatrick	2014	Cognitive Diversity in Undergraduate Engineering: Dyslexia
Benjamin Ahn	2014	Creation of an instrument to measure graduate student and postdoctoral mentoring abilities in engineering and science undergraduate research settings
Jeremi London	2014	The impact of National Science Foundation investments in undergraduate engineering education research: An exploratory mixed methods study
Farrah Fayyaz	2014	A Qualitative Study of Problematic Reasonings of Undergraduate Electrical Engineering Students in Continuous Time Signals and Systems Courses
Marisol Mercado Santiago	2014	Culturally Responsive Engineering Education: A Case Study of a Pre-College IntroductoryEngineeringCourseatTibetanChildren'sVillageSchoolofSelaku
Xingyu Chen	2014	The Composition of First-Year Engineering Curricula and Its Relationships to Matriculation Models and Institutional Characteristics
Jacqueline McNeil	2014	Engineering Faculty Views of Teaching Quality, Accreditation, and Institutional Climate and How They Influence Teaching Practices

ENGREDU 6100 (3 Credit)
Foundations and the Field of Engineering Education

Time: Day #:## - #:##pm
Classroom: HI ###

Instructor Information

- Instructor: Name
- Email: _____
- Office: HI ###
- Office Hours: By Appointment

Course Description (400 character limit)

This course is designed to prepare students for future courses, and careers in engineering education. Students will engage with literature focusing on theories and frameworks which highlight fundamental issues, questions, and approaches in engineering education.

Course Goals

Following the structure of the OSU EED Graduate Curriculum, this course serves to contribute to student development as seen in Table #. This course does not necessarily seek to fully accomplish any of the listed goals, but contributes to the objectives and outcomes within the goal as shown.

Goals:	*Objectives:*	*Outcomes:*
Students will:	Students will:	Students will be able to:
1. Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs	1A. Engage critical issues in the field with attention to inclusion of multiple perspectives	1.A.(B) Identify several of the contemporary educational issues with attention to inclusion of multiple perspectives and demographics
	1B. Analyze the history and foundations of the education of engineers and the discipline of engineering education in US and international contexts	1.B.(B) Identify broad historical and foundational aspects of engineering education in US and international contexts.
		1.B.(I) Discuss key historical and foundational aspects of engineering education related to contemporary issues in US and international contexts.
	1C. Characterize potential stakeholders and design appropriate engagement strategies	1.C.(B) Identify primary stakeholders of engineering education.
		1.C.(I) Explain relationships among stakeholders and contemporary educational issues.
	1D. Identify and interpret stakeholder needs to develop action plans	1.D.(B) Describe several relevant stakeholder needs.
		1.D.(I) Interpret stakeholder needs in relationship to engineering education.
2. Design, conduct, and critique research in engineering education	2A. Research with attention to inclusion of multiple perspectives and demographics so that research outcomes are more universally relevant	2.A.(B) Identify ways that diverse populations may be impacted negatively and positively by research.
	2C. Construct appropriate research questions in engineering education that address stakeholder needs and advance the field	2.C.(B) Identify appropriate, researchable questions considering relevant literature that address stakeholder needs and advance the field.
	2F. Communicate results of research efforts in traditional and non-traditional	2.F.(B) Differentiate among and select types of dissemination venues for research.

	forms	
	2G. Critique the quality of engineering education research studies of various types presented in different forms	2.G.(B) Identify quality indicators of research.
		2.G.(I) Evaluate the quality of a selected scholarly effort.
	2H. Analyze how a broad array of research projects integrate into the field.	2.H.(B) Recognize prior research conducted in an area of interest.
5. Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits	5B. Demonstrate a mindset that values curiosity and questioning, finds and leverages connections across a wide range of ideas, and creates positive societal value	5.B.(B) Discuss the diverse and rapidly changing world from more than one field of study or perspective with curiosity about potential positive societal values.
	5E. Recognize, analyze, and equitably engage with professional ethical dilemmas	5.E.(B) Recognize complex, multi-layered professional ethical dilemmas.
	5H. Demonstrate empathy and cultural competence across professional interactions	5.H.(B) Identify components of multiple cultural perspectives.
	5J. Value and demonstrate commitment to continuing education and lifelong learning	5.J.(B) Describe multiple continuing education learning experiences explaining the value of lifelong learning.

Table 1: Goals, Objectives, and Outcomes impacted by ENGREDU 6100.

Course Rationale (150 character limit)

This course helps students understand what the field of engineering education is and identify their position within it to guide their proper professional actions.

Course Topics (Learning Objectives)

- Teaching and Learning in engineering education
- Curriculum Development
- Research in Engineering Education
- Change in Engineering Education
- Engineering and Society

Course Materials (Representative Textbook(s)):

Provided by instructor as needed.

Books

- Johri, A., & Olds, B. M. (Eds.). (2014). *Cambridge handbook of engineering education research*. Cambridge University Press.

Week (Date)	Course Topics	Assignment	Class Outcome*
1	**Teaching and Learning**	Reflections on Readings	1A(B) 1B(B)
2	**Teaching and Learning**		
3	**Curricula Development**	Reflections on Readings	1A(B) 1B(B)
4	**Curricula Development**	Student Presentations	
5	**Research in Engineering Education**	Student Presentations	1B(I), 2C(B)
6	**Research in Engineering Education**	Reflections on Readings	2C(B), 2G(B)
7	**Change in Engineering Education**	Student Presentations	1C(B), 2A(B), 2B(B)
8			
9	**Change in Engineering Education**	Essay Questions	---
10	**Engineering and Society**	Reflections on Readings	1C(B), 1D(B), 5E(B)
11	**Engineering and Society**	Student Presentations	1C(I), 1D(I), 2F(B), 5E(I)
12	**Engineering and Society**	---	2G(B), 2G(I)
13	**What is Engineering Education?**	Develop/Write Personal Statements	2C(B), 5B(B), 5B(I), 5J(B)
14			
15	**What is Engineering Education?**	Peer Critique	2B(B), 5B(I)

* See Table 1

Grades
The course is graded on a standard A-E scale. Course grades will be calculated accordingly:

- **Participation - 20%:** To adequately participate in class, you must complete any required preparation work (readings, videos, etc.) and be engaged throughout each class period.
- **Interest in Engineering Education Statement - 10%:** See handout.
- **Group Presentation/Discussion on Topic of the Day - 20%** (10% each): See handout.
- **Synthesis Essays - 30%** (10% each): See handout.
- **Visualization - 20%:** See handout.

Attendance
Attendance and active participation are required to pass this course and to have an impact on your teaching in a meaningful way. You may have up to two excused absences in this version of the course and still pass the class. If you will be absent, you must notify the instructor as soon as possible. Excused absences include being sick, attending a conference, having a job interview, etc. Unexcused absences are not acceptable.

Students with Disabilities
Any student who feels s/he may need an accommodation based on the impact of a disability should contact the instructor privately to discuss your specific needs. Please contact Student Life Disability Services at 614-292-3307 in room 150 Pomerene Hall to coordinate reasonable accommodations for students with documented disabilities.

Carmen
Carmen is OSU's course management system. Please note that we will be using the Canvas version of Carmen. Carmen uses include:

- Check the "News" items for any course-related or on-campus activities announcements.
- Check your grades from the "Grades" link on the main toolbar in Carmen.
- Access materials for the course from the "Content" link on the main toolbar.
- Access evaluation tools (i.e., surveys, quizzes, etc.) from the "Activities" link on the main toolbar.

Carmen may be accessed at http://carmen.osu.edu. For troubleshooting, call 688-HELP or go to https://resourcecenter.odee.osu.edu/canvas/getting-started-canvas-students.

Academic Misconduct
Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus may constitute academic misconduct.

The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University,

or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's Code of Student Conduct is never considered an excuse for academic misconduct, so it is recommended that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.

If your instructor suspects that a student has committed academic misconduct in this course, he/she is obligated by University Rules to report suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact your instructor.

Ohio State Sexual Harassment Policy

The University administration, faculty, staff, student employees, and volunteers are responsible for assuring that the University maintains an environment for work and study free from sexual harassment. Sexual harassment is unlawful and impedes the realization of the University's mission of distinction in education, scholarship, and service. Sexual harassment violates the dignity of individuals and will not be tolerated. The University community seeks to eliminate sexual harassment through education and by encouraging faculty, staff, student employees, and volunteers to report concerns or complaints. Prompt corrective measures will be taken to stop sexual harassment whenever it occurs. Source: http://hr.osu.edu/policy/policy115.pdf

Student Permission for Program Publicity

During your participation in this course, photographs, printed material, and videotapes may be made for the purpose of informing the university community and the general public about activities in the college. Student images in the above media may be used to promote college programs and to make public announcements of student accomplishments and those of other students. If you do not wish for your image to be used, please let your instructor know.

Information for Distressed Students

A recent American College Health Survey found stress, sleep problems, anxiety, depression, interpersonal concerns, death of a significant other, and alcohol use among the top ten health impediments to academic performance.

Students experiencing personal problems or situational crises during the quarter are encouraged to contact the OSU Counseling and Consultation Service (614-292-5766; www.ccs.osu.edu) for assistance, support and advocacy.

This service is free and confidential.

ENGREDU 6200 (3 Credit)
Learning Theory, Pedagogy, and Assessment in Engineering Education

Time: Day #:## - #:##pm
Classroom: HI ###

Instructor Information

- Instructor: Name
- Email: _____
- Office: HI ###
- Office Hours: By Appointment

Course Description (400 character limit)

This course is designed to provide foundational understandings of educational learning theory, pedagogy and assessment methods within engineering education. The processes learned will inform research and instructional practice decisions, approaches and analysis.

Course Goals

Following the structure of the OSU EED Graduate Curriculum, this course serves to contribute to student development as seen in Table #. This course does not necessarily seek to fully accomplish any of the listed goals, but contributes to the objectives and outcomes within the goal as shown.

Goals:	*Objectives:*	*Outcomes:*
Students will:	Students will:	Students will be able to:
1.identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs	1A. Engage critical issues in the field with attention to inclusion of multiple perspectives	1.A.(B) Identify several of the contemporary educational issues with attention to inclusion of multiple perspectives and demographics
		1.A.(I) Discuss the main perspectives of contemporary educational issues and describe impact on stakeholders with attention to inclusion of multiple perspectives and demographics.
	1.B. Analyze the history and foundations of the education of engineers and the discipline of engineering education in US and international contexts	1.B.(B) Identify broad historical and foundational aspects of engineering education in US and international contexts.
		1.B.(I) Discuss key historical and foundational aspects of engineering education related to contemporary issues in US and international contexts.
	1.C. Characterize potential stakeholders and design appropriate engagement strategies	1.C.(B) Identify primary stakeholders of engineering education.
		1.C.(I) Explain relationships among stakeholders and contemporary educational issues.
	1.D. Identify and interpret stakeholder needs to develop action plans	1.D.(B) Describe several relevant stakeholder needs.

	2.G. Critique the quality of engineering education research studies of various types presented in different forms	2.G.(B) Identify quality indicators of research.
		2.G.(I) Evaluate the quality of a selected scholarly effort.
	2.H. Analyze how a broad array of research projects integrate into the field.	2.H.(I) Determine how to make connections across research themes to identify gaps in literature.
3. demonstrate, value, and apply engineering expertise	3.C.Formulate applications of engineering education to engineering practice and vice versa.	3.C.(B) Discuss a novel solution and translate language to and from engineering and engineering education settings
		3.C.(I) Design and propose a novel solution to and from engineering and engineering education settings
4. create, teach, and assess courses and curricula	4.A. Educate with attention to inclusion of multiple perspectives and demographics so that every student has the opportunity to learn	4.A.(B) Discuss student and teacher similarities and differences across multiple perspectives and demographics
	4.B. Design a course or other significant educational experience founded in learning theory explicitly addressing stakeholder needs	4.B.(I) Critique an existing course syllabus using learning theory.
		4.B.(A) Develop a course syllabus and discuss the choices made founded in learning theory explicitly addressing stakeholder needs.
	4.C. Analyze how multiple courses integrate into a curriculum	4.C.(B) Evaluate a course's significance and effectiveness in the context of other courses in a curriculum.
		4.C.(I) Synthesize a set of courses' impact on students' learning across a curriculum.
		4.C.(A) Propose curricular adjustments to address gaps in achieving learning outcomes.
	4.D. Instruct a course or other significant educational experience using appropriate and evidence-based pedagogical techniques	4.D.(B) Observe a course or other significant educational experience, highlighting the various techniques used and their appropriateness to the context.
	4.E. Assess and improve their own teaching through informed, inquiry-based practice	4.E.(B) Reflect on one's teaching experiences highlighting strengths and areas for improvement
		4.E.(I) Critique different examples of teaching, highlighting the various techniques used and their appropriateness to the context.

	4.F. Develop effective tools to evaluate learning	4.F.(B) Create appropriate learning outcomes.
		4.F.(I) Develop tools that measure learning outcomes at various levels.
	4.H. Design and implement evaluations/assessments of a variety of educational programming	4.H.(B) Describe the differences and similarities between assessment and evaluation.
		4.H.(I) Critique an educational program using appropriate assessment and evaluation tools.
5. Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits	5.B. Demonstrate a mindset that values curiosity and questioning, finds and leverages connections across a wide range of ideas, and creates positive societal value	5.B.(B) Explain the appropriate communication strategies to use with a range of audiences using multiple modes and media.
		5.B.(I) Connect examples, facts, or theories from more than one field of study or perspective and describe how positive societal value is created.
	5.D. Communicate effectively with a range of audiences using multiple modes and media	5.D.(B) Explain the appropriate communication strategies to use with a range of audiences using multiple modes and media.
		5.D.(I) Critique specific communications considering a range of potential audiences.
	5.E. Recognize, analyze, and equitably engage with professional ethical dilemmas	5.E.(B) Recognize complex, multi-layered professional ethical dilemmas.
		5.E.(I) Critique appropriate perspectives and theories used to analyze professional ethical dilemmas, considering full implications.
	5.H. Demonstrate empathy and cultural competence across professional interactions	5.H.(B) Identify components of multiple cultural perspectives.

Table #: Goals, Objectives, and Outcomes impacted by ENGREDU 6200.

Course Rationale (150 character limit)

This course prepares students to contribute to both research and practice in the field of engineering and engineering education by acquiring background in learning theory, pedagogy / andragogy, and assessment / accreditation/ evaluation of learning.

Course Topics (Learning Objectives)

- Pedagogy, Epistemology, and Metacognition
- Learning Theories
- Assessment and Evaluation
- Accreditation and ABET
- Learning Environments in Engineering Education

Course Materials (Representative Textbook(s)):
Provided by instructor as needed.

Week (Date)	Course Topics	Assignment	Class Outcome*
1	Pedagogy, Epistemology, Metacognition	Discussion Worksheet	1A(B), 1B(B), 1C(B)
2	Pedagogical Approaches	Reflections on Readings	1C(I)
3	Course Design	Course Critique	
4	Positivism and Post-Positivism		4A(B), 4F(B), 5D(B), 5H(B)
5	Critical Theory and Constructivism	Rubric Development	4F(I)
6	Learning Theories	Micro-Teaching Session	4A(I), 4D(B), 5D(I)
7	Learning Theories in Engineering	Peer Evaluation	4E(B), 4E(I)
8		Midterm	1A(I), 1B(I), 1D(B)
9	Learning Environments in Engineering	Reflections on Presentation	4B(I), 4D(B)
10	Assessment and Evaluation in Engineering	Course Critique	4H(B), 4H(I), 5B(B), 5B(I), 5E(B), 5E(I)
11	ABET	Reflections on Readings	4B(A)
12	Assessment in Engineering Education	Reflections on Readings	2G(B), 4C(B), 4C(I), 4C(A)
13	Research in Engineering Education	Syllabus Development	2G(I)
14	Work Day	Curricular Critique	3C(B), 3C(I)
15		Micro-Teaching Session	

* See Table 1

Grades
The course is graded on a standard A-E scale. Course grades will be calculated accordingly:

- Participation - 20%: To adequately participate in class, you must complete any required preparation work (readings, videos, etc.) and be engaged throughout each class period.
- Research Statement - 10%: See handout.
- Group Presentation/Discussion on Topic of the Day - 20%: See handout.
- Synthesis Essays - 30% (10% each): See handout.
- Visualization - 20%: See handout.

Attendance
Attendance and active participation are required to pass this course and to have an impact on your teaching in a meaningful way. You may have up to two excused absences in this version of the course and still pass the class. If you will be absent, you must notify the instructor as soon as possible. Excused absences include being sick, attending a conference, having a job interview, etc. Unexcused absences are not acceptable.

Students with Disabilities
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Academic Misconduct
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Ohio State Sexual Harassment Policy

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Student Permission for Program Publicity

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Information for Distressed Students

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This service is free and confidential.

ENGREDU 7189.01 (1 Credit)
GTA Preparation and Support

Time: Thursdays 5:30-6:30pm
Classroom: HI 244G

Instructor Information

- Instructor: Rachel Kajfez
- Email: Kajfez.2@osu.edu
- Office: HI 244
- Office Hours: By Appointment

Course Description

This course supplements Graduate Teaching Assistant (GTA) content based training by exposing GTAs to instructional pedagogies. It is a practical introduction to engineering education for GTAs. Topics include using assessment for learning, best practices in instructional methods, techniques for self-reflection, etc. This version of the course is designed for new GTAs.

Course Goals

Following the structure of the OSU EED Graduate Curriculum, this course serves to contribute to student development as seen in Table 1. This course does not necessarily seek to fully accomplish any of the listed goals, but contributes to the objectives and outcomes within the goal as shown.

Goals:	*Objectives:*	*Outcomes:*
Students will:	Students will:	Students will be able to:
1. Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs	E. Contribute to high-impact efforts to use and/or transform engineering education to best meet stakeholder needs	(B) Actively participate in an effort that leads to specific application or transformation of engineering education to meet stakeholder needs
3. Demonstrate, value, and apply engineering expertise	C. Formulate applications of engineering education to engineering practice and vice versa	(B) Discuss a novel solution and translate language to and from engineering and engineering education settings
4. Create, teach, and assess courses and curricula	A. Educate with attention to inclusion of multiple perspectives and demographics so that every student has the opportunity to learn	(A) Engage all students in a given educational experience so that every student has the opportunity to learn
	B. Design a course or other significant educational experience founded in learning theory explicitly addressing stakeholder needs	(B) Build a lesson plan addressing stakeholder needs
	C. Analyze how multiple courses integrate into a curriculum	(B) Evaluate a course's significance and effectiveness in the context of other courses in a curriculum
	D. Instruct a course or other significant educational experience	(A) Use appropriate and evidence-based pedagogical techniques while teaching a course

	using appropriate and evidence-based pedagogical techniques	(I) Teach effectively a course or other significant educational experience
	E. Assess and improve their own teaching through informed, inquiry-based practice	(B) Reflect on one's teaching experiences highlighting strengths and areas for improvement
		(I) Critique different examples of teaching, highlighting the various techniques used and their appropriateness to the context
	F. Develop effective tools to evaluate learning	(I) Develop tools that measure learning outcomes at various levels
	G. Evaluate and improve student learning responsibly, equitably, and in alignment with learning outcomes	(B) Identify students' level of knowledge, skills, and abilities responsibly, equitably, and in alignment with learning outcomes
		(I) Determine students' difficulties in alignment with various learning outcomes
	H. Design and implement evaluations/assessments of a variety of educational programming	(B) Describe the differences and similarities between assessment and evaluation
5. Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits	A. Engage in professional activities with attention to inclusion of multiple perspectives and demographics in order to create synergy in the midst of differences	(B) Reflect with curiosity about what can be learned from communities and cultures with attention to inclusion of multiple perspectives and demographics in order to create synergy in the midst of differences
	C. Function effectively on diverse, multidisciplinary teams	(I) Participate effectively on a diverse, multidisciplinary team
	F. Demonstrate effective leadership skills	(I) Critique leadership skills of select individuals, considering visioning, conflict and resource management, and mentoring
	H. Demonstrate empathy and cultural competence across professional interactions	(I) Demonstrate empathetic connection to the complexity of elements important to multiple cultures

Table 1: Goals, Objectives, and Outcomes impacted by ENGREDU 7189.01.

Course Rationale

This course helps students develop a deeper relationship between the practices of teaching and learning in engineering education through experiential based activities.

Course Topics

- Teaching Statements
- Teaching Reviews
- Curriculum Development
- Critical Feedback and Reflection
- Assessment and Evaluation

Course Materials:

Provided by instructor as needed.

Course Schedule:

Week (Date)	Course Topics	Assignment	Class Outcome*
1	Course Overview Getting to Know Your Students		
2	Teaching Philosophies and Pedagogy	Teaching Statement	4A(A), 4E(I), 5F(I)
3	Classroom Incivilities		
4	Teaching Reviews	Instructor Evaluation of Teaching	4D(I), 5C(I)
5	Teaching Teaming		
6	Classroom Assessment Techniques	Assessment Development and Implementation	4F(I), 4H(B)
7	Topic of Choice		
8	Diversity and Inclusion	Teaching Feedback and Synthesis	4E(B), 4E(I), 5F(I)
9	Topic of Choice		
10	Crafting an Evaluation	Personalized Peer Teaching Evaluation	4G(I), 4A(a), 4D(I), 4E(I), 5F(I), 4D(A), 5C(I)
11	*No Class*		
12	Evaluations and Critiques	Course Element Redesign	4C(B), 4B(B), 4G(B), 3C(B), 1E(B)
13	Topic of Choice		
14	The Power of Reflection	Teaching Reflection and Plan for the Future	5A(B), 5H(I)
15	Debriefing Course Evaluation		

* See Table 1

Grades

The course is graded on a standard A-E scale. Course grades will be calculated accordingly:

- **Participation - 20%:** To adequately participate in class, you must complete any required preparation work (readings, videos, etc.) and be engaged throughout each class period.
- **Teaching Statement - 10%:** See handout.
- **Assessment Development and Implementation - 10%** (10% each): See handout.
- **Teaching Feedback and Synthesis - 10%** (10% each): See handout.
- **Personalize Peer Teaching Evaluation - 20%:** See handout.
- **Course Element Redesign – 15%:** See handout.
- **Teaching Reflection and Plan for the Future – 15%:** See handout.

Attendance
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Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

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Ohio State Sexual Harassment Policy

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Information for Distressed Students

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This service is free and confidential.

ENGREDU 7189.02 (1 Credit)
GTA Professional Development

Time: Wednesdays 5:30-6:30pm
Classroom: HI 244G

Instructor Information

- Instructor: Rachel Kajfez
- Email: Kajfez.2@osu.edu
- Office: HI 244
- Office Hours: By Appointment

Course Description

This course supplements Graduate Teaching Assistant (GTA) content based training by exposing GTAs to instructional pedagogies. It is a practical extension of ENGREDU 7189.01. Topics include developing new teaching modules, creating training materials for fellow GTAs, furthering techniques for reflection, etc. This version of the course is designed for experienced GTAs.

Course Goals

Following the structure of the OSU EED Graduate Curriculum, this course serves to contribute to student development as seen in Table 1. This course does not necessarily seek to fully accomplish any of the listed goals, but contributes to the objectives and outcomes within the goal as shown.

Goals:	*Objectives:*	*Outcomes:*
Students will:	Students will:	Students will be able to:
1. Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs	E. Contribute to high-impact efforts to use and/or transform engineering education to best meet stakeholder needs	(B) Actively participate in an effort that leads to specific application or transformation of engineering education to meet stakeholder needs
3. Demonstrate, value, and apply engineering expertise	C. Formulate applications of engineering education to engineering practice and vice versa	(I) Design and propose a novel solution to and from engineering and engineering education settings
4. Create, teach, and assess courses and curricula	A. Educate with attention to inclusion of multiple perspectives and demographics so that every student has the opportunity to learn	(A) Engage all students in a given educational experience so that every student has the opportunity to learn
	B. Design a course or other significant educational experience founded in learning theory explicitly addressing stakeholder needs	(I) Critique an existing course syllabus using learning theory
	C. Analyze how multiple courses integrate into a curriculum	(A) Propose curricular adjustments to address gaps in achieving learning outcomes
	D. Instruct a course or other significant educational experience using appropriate and evidence-based pedagogical techniques	(A) Use appropriate and evidence-based pedagogical techniques while teaching a course

	E. Assess and improve their own teaching through informed, inquiry-based practice	(A) Gather and apply teaching feedback
	F. Develop effective tools to evaluate learning	(A) Revise tools and learning outcomes based on experiences and student feedback
	G. Evaluate and improve student learning responsibly, equitably, and in alignment with learning outcomes	(I) Determine students' difficulties in alignment with various learning outcomes
		(A) Develop responsible and equitable strategies to assist students in their learning that align with learning outcomes
	H. Design and implement evaluations/assessments of a variety of educational programming	(I) Critique an educational program using appropriate assessment and evaluation tools
		(A) Develop a tool to assess and evaluate the effectiveness of an educational program
5. Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits	A. Engage in professional activities with attention to inclusion of multiple perspectives and demographics in order to create synergy in the midst of differences	(B) Reflect with curiosity about what can be learned from communities and cultures with attention to inclusion of multiple perspectives and demographics in order to create synergy in the midst of differences
		(I) Demonstrate evidence of adjustment in attitudes and beliefs through working within and learning from diverse communities and cultures
	C. Function effectively on diverse, multidisciplinary teams	(I) Participate effectively on a diverse, multidisciplinary team
	F. Demonstrate effective leadership skills	(I) Critique leadership skills of select individuals, considering visioning, conflict and resource management, and mentoring
	H. Demonstrate empathy and cultural competence across professional interactions	(I) Demonstrate empathetic connection to the complexity of elements important to multiple cultures

Table 1: Goals, Objectives, and Outcomes impacted by ENGREDU 7189.02.

Course Rationale

This course helps students further explore the relationship between practices of teaching and learning in engineering through experiential based activities.

Course Topics

- Teaching Philosophies
- Teaching Reviews
- Curriculum Development
- Critical Feedback and Reflection
- Assessment and Evaluation

Course Materials:

Provided by instructor as needed.

Course Schedule:

Week (Date)	Course Topics	Assignment	Class Outcome*
1	Course Overview Understanding Your Teaching Perspective	Teaching Philosophy	5A(B)
2	GTA Development Theories	Professional Development Teaching Plan	1E(B)
3	Individual Meetings		
4	Student Evaluations and Reflecting on Feedback	Student Evaluation Tool	4H(A), 4H(A), 4A(A), 4D(A)
5	*No Class*		
6	Individual Meetings	Critique Syllabus and Course	3C(I), 4C(A), 4B(I), 4H(I)
7	Topic of Choice		
8	Translating Teaching Experience to Other Contexts	Teaching Feedback and Synthesis	4E(A)
9	Topic of Choice		
10	Individual Meetings		
11	*No Class*	Student Evaluation Tool Revision	4F(A), 4H(A), 4E(A), 4G(I)
12	Topic of Choice		
13	Topic of Choice		
14	Individual Meetings	Teaching Philosophy Revision and Critique Your Own Teaching	5A(I), 5H(I), 5F(I), 4G(A), 5C(I)
15	Debriefing Course Evaluation		

* See Table 1

Grades

The course is graded on a standard A-E scale. Course grades will be calculated accordingly:

- **Participation – 20%:** To adequately participate in class, you must complete any required preparation work (readings, videos, etc.) and be engaged throughout each class period.
- **Teaching Philosophy and Revision/Critique – 20%:** See handout.
- **Professional Development Teaching Plan – 20%:** See handout.
- **Student Evaluation Tool and Revision – 20%:** See handout.
- **Peer Review of Teaching – 10%:** See handout.
- **Teaching Feedback and Synthesis – 10%:** See handout.

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ENGREDU 7780 (3 Credit)
Engineering Education Research Methods

Time: Day #:## - #:##pm
Classroom: HI ###

Instructor Information

- Instructor: Name
- Email: _____
- Office: HI ###
- Office Hours: By Appointment

Course Description (400 character limit)

This course is designed to prepare students for productive research in engineering education throughout their graduate experience and professional careers. Research methods are highlighted and explored including quantitative, qualitative, and mixed methods.

Course Goals

Following the structure of the OSU EED Graduate Curriculum, this course serves to contribute to student development as seen in Table #. This course does not necessarily seek to fully accomplish any of the listed goals, but contributes to the objectives and outcomes within the goal as shown.

Goals:	*Objectives:*	*Outcomes:*
Students will:	Students will:	Students will be able to:
1.identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs	1A. Engage critical issues in the field with attention to inclusion of multiple perspectives	1.A.(B) Identify several of the contemporary educational issues with attention to inclusion of multiple perspectives and demographics
		1.A.(I) Discuss the main perspectives of contemporary educational issues and describe impact on stakeholders with attention to inclusion of multiple perspectives and demographics.
	1.E. Contribute to high-impact efforts to use and/or transform engineering education to best meet stakeholder needs	1.E.(B) Actively participate in an effort that leads to specific application or transformation of engineering education to meet stakeholder needs.
2. design, conduct, and critique research in engineering education	2A. Research with attention to inclusion of multiple perspectives and demographics so that research outcomes are more universally relevant	2.A.(B) Identify ways that diverse populations may be impacted negatively and positively by research.
		2.A.(I) Reflect critically on research across various fields that targets diverse audiences.
	2.B. Demonstrate awareness of broadly applicable research opportunities, funding, resources, and communications (internal and external to the field)	2.B.(B) Identify current research opportunities and communications within and outside of engineering education.

	2C. Construct appropriate research questions in engineering education that address stakeholder needs and advance the field	2.C.(B) Identify appropriate, researchable questions considering relevant literature that address stakeholder needs and advance the field.
		2.C.(I) Appraise whether research questions appropriately align with an overall research study design, address stakeholder needs, and advance the field and contributes to larger body of knowledge in engineering education.
		2.C.(A) Develop sound engineering education research questions that address stakeholder needs and advance the field.
	2.D. Design research that uses appropriate and evidence-based methods	2.D.(B) Define qualitative, quantitative, and mixed methods commonly used within and outside of engineering education research.
		2.D.(I) Select appropriate methods to research questions.
	2.E. Collect, analyze, and interpret data using appropriate techniques	2.E.(B) Collect, analyze, and interpret data within a given set of research parameters
	2F. Communicate results of research efforts in traditional and non-traditional forms	2.F.(B) Differentiate among and select types of dissemination venues for research.
	2G. Critique the quality of engineering education research studies of various types presented in different forms	2.G.(B) Identify quality indicators of research.
		2.G.(I) Evaluate the quality of a selected scholarly effort.
	2H. Analyze how a broad array of research projects integrate into the field.	2.H.(B) Recognize prior research conducted in an area of interest.
	2.I. Structure, manage, and implement research projects.	2.I.(B) Define the aspects of research project management.
		2.I.(I) Develop a structured plan to manage a research study for implementation.
5. identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits	5.C. Function effectively on diverse, multidisciplinary teams	5.C.(B) Discuss the elements of effective teamwork and importance of diverse, multidisciplinary teams.
	5.D. Communicate effectively with a range of audiences using multiple modes and media	5.D.(B) Explain the appropriate communication strategies to use with a range of audiences using multiple modes and media.
		5.D.(I) Critique specific communications considering a range of potential audiences.
	5.E. Recognize, analyze, and equitably engage with professional ethical dilemmas	5.E.(B) Recognize complex, multi-layered professional ethical dilemmas.

	5.G. Apply appropriate principles to manage teams and projects	5.G.(B) Describe the project management process and primary constraints including scope, schedule, budget, and quality.

Table #: Goals, Objectives, and Outcomes impacted by ENGREDU 6100.

Course Rationale (150 character limit)
This course prepares students to perform research by using research methods appropriate to the field of engineering education..

Course Topics (Learning Objectives)
- Teaching and Learning in engineering education
- Curriculum Development
- Research in Engineering Education
- Change in Engineering Education
- Engineering and Society

Course Materials (Representative Textbook(s)):
Provided by instructor as needed.

Week (Date)	Course Topics	Assignment	Class Outcome*
1	What are you curious about? Research Process		
2	What is a research question? (scope, focus, etc.); Frameworks and Lens (theory)	Research Statement	4A(A), 4E(I), 5F(I)
3	Methods		
4	Presentation Skills; Methods	Methods Presentation	4D(I), 5C(I)
5	Methods		
6	Lit Reviews; How to find and manage and read papers; Information Literacy Management	Assessment Development and Implementation	4F(I), 4H(B)

7	IRB; Collecting Data	Mini-Lit Review	
8	Finding; Proposals	Teaching Feedback and Synthesis	4E(B), 4E(I), 5F(I)
9	Validity and Reliability		
10	Analysis Resources; Data Management	Personalized Peer Teaching Evaluation	4G(I), 4A(a), 4D(I), 4E(I), 5F(I), 4D(A), 5C(I)
11	*Effective Meetings*		
12	Optimizing Expert's Time	Course Element Redesign	4C(B), 4B(B), 4G(B), 3C(B), 1E(B)
13	Presentation skills; Presenting your work (posters and various papers); Draft poster/ practice session		
14	Poster session; Research wrap up	Teaching Reflection and Plan for the Future	5A(B), 5H(I)
15			

* See Table 1

Grades

The course is graded on a standard A-E scale. Course grades will be calculated accordingly:

- Participation - 20%: To adequately participate in class, you must complete any required preparation work (readings, videos, etc.) and be engaged throughout each class period.
- Interest in Engineering Education Statement - 10%: See handout.
- Group Presentation/Discussion on Topic of the Day - 20%: See handout.
- Synthesis Essays - 30% (10% each): See handout.
- Visualization - 20%: See handout.

Attendance

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the course and still pass the class. If you will be absent, you must notify the instructor as soon as possible. Excused absences include being sick, attending a conference, having a job interview, etc. Unexcused absences are not acceptable.

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ENGREDU 7881 (3 Credit)
Engineering Education Seminar

Time: Day #:## - #:## pm
Classroom: HI ###

Instructor Information

- Instructor: Name
- Email: _____
- Office: HI ###
- Office Hours: By Appointment

Course Description (400 character limit)

This course is designed to provide students with the ability to maintain contemporary knowledge of the field of engineering education, understand how to communicate within the field, provide exposure to different stakeholders, and build community among engineering educators.

Course Goals

Following the structure of the OSU EED Graduate Curriculum, this course serves to contribute to student development as seen in Table #. This course does not necessarily seek to fully accomplish any of the listed goals, but contributes to the objectives and outcomes within the goal as shown.

Goals:	*Objectives:*	*Outcomes:*
Students will:	Students will:	Students will be able to:
1. Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs	1A. Engage critical issues in the field with attention to inclusion of multiple perspectives	1.A.(I) Discuss the main perspectives of contemporary educational issues and describe impact on stakeholders with attention to inclusion of multiple perspectives and demographics.
	1.B. Analyze the history and foundations of the education of engineers and the discipline of engineering education in US and international contexts	1.B.(I) Discuss key historical and foundational aspects of engineering education related to contemporary issues in US and international contexts.
	1.C. Characterize potential stakeholders and design appropriate engagement strategies	(I) Explain relationships among stakeholders and contemporary educational issues.
	1.D. Identify and interpret stakeholder needs to develop action plans	(I) Interpret stakeholder needs in relationship to engineering education.
2. Design, conduct, and critique research in engineering education	2A. Research with attention to inclusion of multiple perspectives and demographics so that research outcomes are more universally relevant	2.A.(I) Reflect critically on research across various fields that targets diverse audiences.
	2.B. Demonstrate awareness of broadly applicable research opportunities, funding, resources, and communications (internal and	2.B.(B) Identify current research opportunities and communications within and outside of engineering education.

	external to the field)	
	2.C. Construct appropriate research questions in engineering education that address stakeholder needs and advance the field	2.C.(I) Appraise whether research questions appropriately align with an overall research study design, address stakeholder needs, and advance the field and contributes to larger body of knowledge in engineering education.
	2.G. Critique the quality of engineering education research studies of various types presented in different forms	2.G.(I) Evaluate the quality of a selected scholarly effort.
	2.H. Analyze how a broad array of research projects integrate into the field.	2.H.(I) Determine how to make connections across research themes to identify gaps in literature.
5. Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits	5.A. Engage in professional activities with attention to inclusion of multiple perspectives and demographics in order to create synergy in the midst of differences.	5.A.(I) Discuss the elements of effective teamwork and importance of diverse, multidisciplinary teams.
	5.B. Demonstrate a mindset that values curiosity and questioning, finds and leverages connections across a wide range of ideas, and creates positive societal value	5.B.(B) Explain the appropriate communication strategies to use with a range of audiences using multiple modes and media.
	5.D. Communicate effectively with a range of audiences using multiple modes and media	(B) Explain the appropriate communication strategies to use with a range of audiences using multiple modes and media.
		5.D.(I) Critique specific communications considering a range of potential audiences.
		(A) Disseminate/publish appropriate to target audience(s) using multiple modes and media.
	5.E. Recognize, analyze, and equitably engage with professional ethical dilemmas	5.E.(B) Recognize complex, multi-layered professional ethical dilemmas.
	5.I. Prepare professional documents and demonstrate effective communication skills appropriate to a variety of job search and career advancement processes	5.I.(B) Describe documents prepared regularly in professional career contexts and identify quality indicators of each.
	5.J. Value and demonstrate commitment to continuing education and lifelong learning	5.J.(B) Describe multiple continuing education learning experiences explaining the value of lifelong learning.

Table #: Goals, Objectives, and Outcomes impacted by ENGREDU 6100.

Course Rationale (150 character limit)
This course prepares students to be conversant with contemporary issues and topics within the field of engineering education and associated disciplines.

Course Topics (Learning Objectives)
- Contemporary issues and dialogs of Engineering Education
- Journal Review and Discussion
- Communication within Engineering Education
- Professional Development
- Research in Engineering Education
- Research outside of Engineering Education and its relation to our field

Course Materials (Representative Textbook(s)):
Provided by instructor as needed.

Week (Date)	Course Topics	Assignment	Class Outcome*
1	Introduction to Seminar/Setting the Stage	Reflections on Readings	
2	Research Presentation in Engineering Education (EED Member)		2B (B)
3	Teaching Presentation	Reflections on Readings	1A (I)
4	Teaching-Related Discussion		1A (I)
5	Research Presentation - Non Engineering Education	Reflections on Readings	2A (I), 2B (B)
6			
7	Journal Article Discussion	On-line Essays	
8	Professional Development Presentation		5J (B), 5I(B)
9	Panel Discussion	Reflections on Presentation	2B (I), 2D (I), 5E (A)
10	Professional Development Mini-Workshop		5A (I), 5D (B)
11	Research Presentation in Engineering Education (Non EED Member)		2A (I), 2B (B)

12	Student Facilitated Discussion	Reflections on Presentation	1C (I), 1D (I), 5A (I)
13	Student Team Presentations		1C (I), 1D (I), 5A (I), 5B (A)
14		Reflections on Presentation	1C (I), 1D (I), 5A (I), 5B (A)
15			5B (A), 5D (I), 5D (A)

* See Table 1

Grades

The course is graded on a standard A-E scale. Course grades will be calculated accordingly:

- **Participation - 40%:** To adequately participate in class, you must complete any required preparation work (readings, videos, etc.) and be engaged throughout each class period.
- **Reflections on Engineering Education Statement - 30%:** See handout.
- **Group Presentation/Discussion on Topic of the Day - 20%** (10% each): See handout.
- **Synthesis Essays - 10%**: See handout.

Attendance

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This service is free and confidential.

ENGREDU 7900 (3 Credit)
Career Exploration and Professional Development

Time: Day #:## - #:##pm
Classroom: HI ###

Instructor Information

- Instructor: Name
- Email: _____
- Office: HI ###
- Office Hours: By Appointment

Course Description (400 character limit)

This course is designed to prepare students for future careers and professional advancement at universities, colleges, community colleges, and technical colleges (both in tenure-track and clinical faculty appointments), government agencies, private industry, corporate training organizations, non-profits, and high schools challenged with incorporating engineering design into core science standards.

Course Goals

Following the structure of the OSU EED Graduate Curriculum, this course serves to contribute to student development as seen in Table #1. This course does not necessarily seek to fully accomplish any of the listed goals, but contributes to the objectives and outcomes within the goal as shown.

Goals:	*Objectives:*	*Outcomes:*
Students will:	Students will:	Students will be able to:
1. Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs	1A. Engage critical issues in the field with attention to inclusion of multiple perspectives	1.A.(I) Discuss the main perspectives of contemporary educational issues and describe impact on stakeholders with attention to inclusion of multiple perspectives and demographics.
	1.B. Analyze the history and foundations of the education of engineers and the discipline of engineering education in US and international contexts	1.B.(I) Discuss key historical and foundational aspects of engineering education related to contemporary issues in US and international contexts.
		1.B.(A) Synthesize relevant educational history and foundations of critical contemporary issues in US and international contexts.
	1.C. Characterize potential stakeholders and design appropriate engagement strategies	1.C.(B) Identify primary stakeholders of engineering education.
		1.C.(I) Explain relationships among stakeholders and contemporary educational issues.
		1.C.(A) Define appropriate engagement strategies with stakeholders.
	1.D. Identify and interpret stakeholder needs to develop	1.D.(B) Describe several relevant stakeholder needs.

	action plans	1.D.(I) Interpret stakeholder needs in relationship to engineering education.
		1.D.(A) Create an action plan to address one or more stakeholder needs.
2. Design, conduct, and critique research in engineering education	2.B. Demonstrate awareness of broadly applicable research opportunities, funding, resources, and communications (internal and external to the field)	2.B.(I) Distinguish between types of resources and funding available and the corresponding reporting expectations.
		2.B.(A) Select appropriate research opportunities, funding, resources, and communications that aligns with one's research interests and expertise.
	2.F. Communicate results of research efforts in traditional and non-traditional forms	2.F.(B) Differentiate among and select types of dissemination venues for research.
	2.H. Analyze how a broad array of research projects integrate into the field.	2.H.(A) Propose a research agenda informed from a synthesis of existing literature and research across multiple fields.
3. Demonstrate, value, and apply engineering expertise	3.D. Identify pathways for lifelong learning in engineering	3.D.(I) Propose a professional development agenda illustrating pathways for lifelong learning in engineering.
		3.D.(A) Demonstrate engagement within opportunities for lifelong learning in engineering.
5. Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits	5.A. Engage in professional activities with attention to inclusion of multiple perspectives and demographics in order to create synergy in the midst of differences.	5.A.(B) Reflect with curiosity about what can be learned from communities and cultures with attention to inclusion of multiple perspectives and demographics in order to create synergy in the midst of differences.
	5.C. Function effectively on diverse, multidisciplinary teams	5.C.(B) Discuss the elements of effective teamwork and importance of diverse, multidisciplinary teams.
	5.D. Communicate effectively with a range of audiences using multiple modes and media	5.D.(I) Critique specific communications considering a range of potential audiences.
		5.D.(A) Disseminate/publish appropriate to target audience(s) using multiple modes and media.
	5.F. Demonstrate effective leadership skills	5.F.(B) Discuss the elements of effective leadership skills, including self-awareness, resource management, and motivating others.
		5.F.(I) Critique leadership skills of select individuals, considering visioning, conflict and resource management, and mentoring.

	5.G. Apply appropriate principles to manage teams and projects	5.G.(B) Describe the project management process and primary constraints including scope, schedule, budget, and quality.
		5.G.(I) Critique project management from a variety of sectors including education, development, and industry.
	5.H. Demonstrate empathy and cultural competence across professional interactions	5.H.(A) Promote empathy and cultural competence across professional interactions.
	5.I. Prepare professional documents and demonstrate effective communication skills appropriate to a variety of job search and career advancement processes	5.I.(B) Describe documents prepared regularly in professional career contexts and identify quality indicators of each.
		5.I.(I) Prepare documents and demonstrate effective communication skills appropriate to a variety of job search and career advancement processes .
		5.I.(A) Solicit feedback from multiple sources and revise professional documents appropriate to career goals.
	5.J. Value and demonstrate commitment to continuing education and lifelong learning	5.J.(B) Describe multiple continuing education learning experiences explaining the value of lifelong learning.
		5.J.(I) Develop and pursue plans for lifelong learning to support career goals.

Table 1: Goals, Objectives, and Outcomes impacted by ENGREDU 7900.

Course Rationale (150 character limit)
This course helps students prepare for successfully engaging in engineering education careers across a variety of institutions and organizations.

Course Topics (Learning Objectives)
- EED Stakeholders
- Career Options and Job Search Dynamics
- Teamwork
- Project Management
- Empathy
- Professional Development

Course Materials (Representative Textbook(s)):
Provided by instructor as needed.

Week (Date)	Course Topics	Assignment	Class Outcome*
1	Critical Issues in Engineering Education		
2	Inclusion of Multiple Perspectives Social Skills/Relationship Building	Reflections on Readings	1A(I), 1B(I), 1B(A), 5A(B)
3	EED Stakeholders Leveraging Your Network	Stakeholder Analysis Memo	1C(B), 1C(I), 1C(A), 1D(B), 1D(I), 1D(A)
4	Faculty Careers and Options	LinkedIn Profile Cover Letter	2B(I), 2B(A)
5	Academic Job Search	Academic CV and Statements of Research/Teaching	2F(B), 2H(A), 5D(B), 5I(B)
6	Industry Careers and Options	ABET, TUEE Analysis Memo	3D(I)
7	Industry Job Search	Industry Resume	3D(A), 5D(I), 5I(B)
8	Government and Non-Commercial Careers and Options	Government Application	5D(A),5C(B)
9	Teamwork	Professional Portfolio	5C(B), 5F(B), 5F(I)
10	Project Management	Job Postings and Search Analysis	5G(B), 5G(I)
11	Empathy in Engineering Education	Career Plan	5H(A)
12	Professional Documents for Job Search	CV / Resume / Application	5I(I), 5I(A)
13	Professional Development Options	Career Plan	5J(B)
14	Entrepreneurial and Intrapreneurial Options	Professional e-Portfolio	5J(I)
15			

* See Table 1

Grades
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The University administration, faculty, staff, student employees, and volunteers are responsible for assuring that the University maintains an environment for work and study free from sexual harassment. Sexual harassment is unlawful and impedes the realization of the University's mission of distinction in education, scholarship, and service. Sexual harassment violates the dignity of individuals and will not be tolerated. The University community seeks to eliminate sexual harassment through education and by encouraging faculty, staff, student employees, and volunteers to report concerns or complaints. Prompt corrective measures will be taken to stop sexual harassment whenever it occurs. Source: http://hr.osu.edu/policy/policy115.pdf

Student Permission for Program Publicity

During your participation in this course, photographs, printed material, and videotapes may be made for the purpose of informing the university community and the general public about activities in the college. Student images in the above media may be used to promote college programs and to make public announcements of student accomplishments and those of other students. If you do not wish for your image to be used, please let your instructor know.

Information for Distressed Students

A recent American College Health Survey found stress, sleep problems, anxiety, depression, interpersonal concerns, death of a significant other, and alcohol use among the top ten health impediments to academic performance.

Students experiencing personal problems or situational crises during the quarter are encouraged to contact the OSU Counseling and Consultation Service (614-292-5766; www.ccs.osu.edu) for assistance, support and advocacy.

Assessment: Assessment Unit Planning

THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Proposed PhD in Engineering Education

Program - Engineering Education (PH)

Outcome: Inclusive engagement with critical issues

1. A. Engage critical issues in the field with attention to inclusion of multiple perspectives and demographics

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Critical Thinking
Outcome Category (Other): Diversity

Assessment Methods

Direct - Other classroom assessment methods - ENGR 6200 - Learning theory, pedagogy and assessment course - discussion worksheet on Pedagogy, Epistemology, and Metacognition as well as midterm exam (Inactive)

Direct - Other classroom assessment methods - ENGR 6200 - Learning theory, pedagogy and assessment course - discussion worksheet on Pedagogy, Epistemology, and Metacognition as well as midterm exam (Active)

Related Goals

Program - Engineering Education (PH)

Skill-Cognitive - Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs

Outcome: History and Foundations

1.B. Analyze the history and foundations of the education of engineers and the discipline of engineering education in the US and international contexts

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Global Perspectives/Issues
Outcome Category (Other): Historical Perspective

Assessment Methods

Direct - Writing assignment - ENGR 6100 - Foundations and the Field of Engineering Education – written reflections on reading (Active)

Related Goals

Program - Engineering Education (PH)

Program - Engineering Education (PH)
Skill-Cognitive - Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs

Outcome: Characterize Potential Stakeholders

1.C. Characterize potential stakeholders and design appropriate engagement strategies

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Communication-Oral
Outcome Category (Other): Interaction with Selected Audiences

Assessment Methods

Direct - Writing assignment - ENGR 6200 - Learning theory, pedagogy and assessment course – course midterm exam (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs

Outcome: Identify and Interpret Stakeholder Needs

1. D. Identify and interpret stakeholder needs to develop action plans

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Cultural Awareness
Outcome Category (Other): Interaction with Selected Audiences

Assessment Methods

Direct - Writing assignment - ENGR 6100 - Foundations and the Field of Engineering Education – written reflections on reading (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs

Outcome: Contribute to high impact efforts

1. E. Contribute to high impact efforts to use and/or transform engineering education to best meet stakeholder needs

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Problem Solving
Outcome Category (Other): Integration and Synthesis

Assessment Methods

Direct - Graduate - Dissertation - Oral presentation/defense - engineering education dissertation defense (Active)

Program - Engineering Education (PH)

Program - Engineering Education (PH)
Skill-Cognitive - Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs

Outcome: Research with attention to inclusion and diversity

2. A. Research with attention to inclusion of multiple perspectives and demographics so that research outcomes are more universally relevant

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Diversity
Outcome Category (Other): Methods / Modes of Inquiry

Assessment Methods

Direct - Student Research - engineering education dissertation research (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Design, conduct, and critique research in engineering education

Outcome: Demonstrate awareness of broadly applicable research

2. B. Demonstrate awareness of broadly applicable research opportunities, funding, resources, and communications (internal and external to the field)

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Information Literacy
Outcome Category (Other): Knowledge-Specialized

Assessment Methods

Direct - Writing assignment - ENGR 7900 - Professional Development in Engineering Education – career plan and statement writing assignment (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Design, conduct, and critique research in engineering education

Outcome: Construct Appropriate Research Questions

2. C. Construct appropriate research questions in engineering education that address stakeholder needs and advance the field

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Methods / Modes of Inquiry

Assessment Methods

Direct - Graduate - Dissertation - Written document - engineering education dissertation written document (Active)

Related Goals

Program - Engineering Education (PH)

Program - Engineering Education (PH)
Skill-Cognitive - Design, conduct, and critique research in engineering education

Outcome: Design research

2. D. Design research that uses appropriate and evidence-based methods

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Methods / Modes of Inquiry

Assessment Methods

Direct - Other classroom assessment methods - ENGR 7780 - Research Methods in Engineering Education – course term project (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Design, conduct, and critique research in engineering education

Outcome: Collect, Analyze, and Interpret Data

2. E. Collect, analyze, and interpret data using appropriate techniques

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Analytical Reasoning/Qualitative
Outcome Category (Other): Analytical Reasoning/Quantitative

Assessment Methods

Direct - Graduate - Dissertation - Oral presentation/defense - engineering education dissertation defense (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Design, conduct, and critique research in engineering education

Outcome: Communicate Research Results

2. F. Communicate results of research efforts in traditional and non-traditional forms

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Communication-Oral
Outcome Category (Other): Communication-Visual, Communication-Written

Assessment Methods

Direct - Publications - engineering education dissertation research (Active)

Related Goals

Program - Engineering Education (PH)

Program - Engineering Education (PH)
Skill-Cognitive - Design, conduct, and critique research in engineering education

Outcome: Critique the Quality of Engineering Education Research

2. G. Critique the quality of engineering education research studies of various types presented in different forms

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Analytical Reasoning/Qualitative
Outcome Category (Other): Analytical Reasoning/Quantitative, Critical Thinking

Assessment Methods

Direct - Other classroom assessment methods - ENGR 7881 - Engineering Education Seminar – discussion, interaction, and reflection with multiple stakeholders and audiences within seminar series (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Design, conduct, and critique research in engineering education

Outcome: Analyze How Research Integrates into Field

2. H. Analyze how a broad array of research projects integrate into the field

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Integration and Synthesis

Assessment Methods

Direct - Other classroom assessment methods - ENGR 7881 - Engineering Education Seminar – discussion, interaction, and reflection with multiple stakeholders and audiences within seminar series (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Design, conduct, and critique research in engineering education

Outcome: Manage Research Projects

2. I. Structure, manage, and implement research projects

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Clinical Skills/Experience
Outcome Category (Other): Generalization and Application

Assessment Methods

Direct - Graduate - Thesis/Comprehensive Examination - Written document - engineering education dissertation written document (Active)

Program - Engineering Education (PH)

Program - Engineering Education (PH)
Skill-Cognitive - Design, conduct, and critique research in engineering education

Outcome: Apply Engineering Mindset to Solve Problems

3. A. Apply an engineering mindset to devise solutions to complex problems with attention to inclusion of multiple perspectives and demographics

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Problem Solving

Assessment Methods

Direct - Portfolio - Engineering portfolio ± MEng or equivalent (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Demonstrate, value, and apply engineering expertise

Outcome: Demonstrate Engineering Competence

3. B. Demonstrate engineering competence in at least one specific domain.

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Knowledge-Specialized
Outcome Category (Other): Professionalism (default for specialized skills and practices, e.g., patient care)

Assessment Methods

Direct - Portfolio - Engineering portfolio ± MEng or equivalent (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Demonstrate, value, and apply engineering expertise

Outcome: Formulate Applications to Engineering Practice

3. C. Formulate applications of engineering education to engineering practice and vice versa

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Generalization and Application

Assessment Methods

Direct - Practicum/fieldwork - ENGR 7189.01 - GTA Preparation and Support – teaching practicum (Active)

Related Goals

Program - Engineering Education (PH)

Program - Engineering Education (PH)
Skill-Cognitive - Demonstrate, value, and apply engineering expertise

Outcome: Identify Pathways to Lifelong Learning

3. D. Identify pathways for lifelong learning in engineering

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Continuous Learning and Adaptability

Assessment Methods

Direct - Other culminating project - ENGR 7900 - Professional Development in Engineering Education – professional e-portfolio (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Demonstrate, value, and apply engineering expertise

Outcome: Educate with Attention to Inclusion

4. A. Educate with attention to inclusion of multiple perspectives and demographics so that every student has the opportunity to learn

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Communication-Instructional
Outcome Category (Other): Cultural Awareness, Diversity

Assessment Methods

Direct - Writing assignment - ENGR 6200 - Learning theory, pedagogy and assessment course – written reflections on reading (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Create, teach, and assess courses and curricula

Outcome: Design a Course Founded in Learning Theory

4. B. Design a course or other significant educational experience founded in learning theory explicitly addressing stakeholder needs

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Communication-Instructional
Outcome Category (Other): Knowledge-Specialized

Assessment Methods

Direct - Practicum/fieldwork - ENGR 7189.02 - GTA Professional Development – teaching practicum (Active)

Program - Engineering Education (PH)

Program - Engineering Education (PH)
Skill-Cognitive - Create, teach, and assess courses and curricula

Outcome: Analyze Courses and Curriculum

4. C. Analyze how multiple courses integrate into a curriculum

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Communication-Instructional
Outcome Category (Other): Integration and Synthesis

Assessment Methods

Direct - Writing assignment - ENGR 6200 - Learning theory, pedagogy and assessment course – written reflections on reading (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Create, teach, and assess courses and curricula

Outcome: Instruct a Course

4. D. Instruct a course or other significant educational experience using appropriate and evidence-based pedagogical techniques

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Clinical Skills/Experience
Outcome Category (Other): Communication-Instructional

Assessment Methods

Direct - Practicum/fieldwork - ENGR 7189.01 - GTA Preparation and Support – teaching practicum (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Create, teach, and assess courses and curricula

Outcome: Assess and Improve Own Teaching

4. E. Assess and improve their own teaching through informed, inquiry-based practice

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Continuous Learning and Adaptability

Assessment Methods

Direct - Practicum/fieldwork - ENGR 7189.01 - GTA Preparation and Support – teaching practicum (Active)

Related Goals

Program - Engineering Education (PH)

Program - Engineering Education (PH)
Skill-Cognitive - Create, teach, and assess courses and curricula

Outcome: Develop Evaluation Tools

4. F. Develop effective tools to evaluate learning

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Integration and Synthesis

Assessment Methods

Direct - Use of Rubrics - ENGR 6200 - Learning theory, pedagogy and assessment course – rubric development (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Create, teach, and assess courses and curricula

Outcome: Evaluate and Improve Student Learning

4. G. Evaluate and improve student learning responsibly, equitably, and in alignment with learning outcomes

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Analytical Reasoning/Qualitative
Outcome Category (Other): Analytical Reasoning/Quantitative, Continuous Learning and Adaptability

Assessment Methods

Direct - Other classroom assessment methods - ENGR 7189.02 - GTA Professional Development – teaching practicum (Active)

Related Goals

Program - Engineering Education (PH)
Skill-Cognitive - Create, teach, and assess courses and curricula

Outcome: Design and Implement Assessments

4. H. Design and implement evaluation/assessments of a variety of educational programming

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Clinical Skills/Experience
Outcome Category (Other): Generalization and Application

Assessment Methods

Direct - Other classroom assessment methods - ENGR 7189.02 - GTA Professional Development – teaching practicum (Active)

Related Goals

Program - Engineering Education (PH)

Program - Engineering Education (PH)
Skill-Cognitive - Create, teach, and assess courses and curricula

Outcome: Engage in Professional Activities

5. A. Engage in professional activities with attention to inclusion of multiple perspectives and demographics in order to create synergy in the midst of differences.

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Diversity
Outcome Category (Other): Professionalism (default for specialized skills and practices, e.g., patient care)

Related Goals

Program - Engineering Education (PH)
Perspectives/Attitudes - Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits

Outcome: Demonstrate a Mindset that Values Curiosity and Questioning

5. B. Demonstrate a mindset that values curiosity and questioning, finds and leverages connections across a wide range of ideas, and creates positive societal value

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Continuous Learning and Adaptability
Outcome Category (Other): Creative Thinking

Assessment Methods

Direct - Graduate - Candidacy/Qualifying Examination - Written document - engineering education oral candidacy exam (Active)

Related Goals

Program - Engineering Education (PH)
Perspectives/Attitudes - Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits

Outcome: Function on Diverse Teams

5. C. Function effectively on diverse, multidisciplinary teams

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Teamwork

Assessment Methods

Direct - Other culminating project - ENGR 7189.01 - GTA Preparation and Support – teaching practicum (Active)

Related Goals

Program - Engineering Education (PH)

Program - Engineering Education (PH)
Perspectives/Attitudes - Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits

Outcome: Communicate Effectively

5. D. Communicate effectively with a range of audiences using multiple modes and media

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Communication-Oral
Outcome Category (Other): Communication-Visual, Communication-Written

Assessment Methods

Direct - Other classroom assessment methods - ENGR 7881 - Engineering Education Seminar – discussion, interaction, and reflection with multiple stakeholders and audiences within seminar series
(Active)

Related Goals

Program - Engineering Education (PH)
Perspectives/Attitudes - Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits

Outcome: Handle Ethical Dilemmas

5. E. Recognize, analyze, and equitably engage with professional ethical dilemmas

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Ethics/Moral Reasoning
Outcome Category (Other): Professionalism (default for specialized skills and practices, e.g., patient care)

Assessment Methods

Direct - Graduate - Candidacy/Qualifying Examination - Written document - engineering education candidacy exam
(Active)

Related Goals

Program - Engineering Education (PH)
Perspectives/Attitudes - Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits

Outcome: Leadership

5. F. Demonstrate effective leadership skills

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Other): Leadership

Assessment Methods

Direct - Writing assignment - ENGR 7900 - Professional Development in Engineering Education – professional portfolio
(Active)

Program - Engineering Education (PH)

Related Goals

Program - Engineering Education (PH)
Perspectives/Attitudes - Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits

Outcome: Teamwork and Project Management

5.G. Apply appropriate principles to manage teams and projects

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Teamwork
Outcome Category (Other): Professionalism (default for specialized skills and practices, e.g., patient care)

Related Goals

Program - Engineering Education (PH)
Perspectives/Attitudes - Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits

Outcome: Empathy and Cultural Competence

5. H. Demonstrate empathy and cultural competence across professional interactions

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Cultural Awareness
Outcome Category (Other): Professionalism (default for specialized skills and practices, e.g., patient care)

Assessment Methods

Direct - Graduate - Candidacy/Qualifying Examination - Written document - engineering education oral candidacy exam (Active)

Related Goals

Program - Engineering Education (PH)
Perspectives/Attitudes - Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits

Outcome: Job Search and Career Advancement Skills

5. I. Prepare professional documents and demonstrate effective communication skills appropriate to a variety of job search and career advancement processes

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Professionalism
Outcome Category (Other): Communication-Oral, Communication-Visual, Communication-Written

Assessment Methods

Direct - Writing assignment - ENGR 7900 - Professional Development in Engineering Education – cv / resume / application development (Active)

Related Goals

Program - Engineering Education (PH)

Program - Engineering Education (PH)
Perspectives/Attitudes - Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits

Outcome: Lifelong Learning

5. J. Value and demonstrate commitment to continuing education and lifelong learning

Outcome Status: Inactive
Planned Assessment Year: Every Year
Outcome Category (Primary): Continuous Learning and Adaptability

Related Goals

Program - Engineering Education (PH)
Perspectives/Attitudes - Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits

Introduction

Introduction:

The Ohio State University is constantly updating its curricula and programs. The recently established Department of Engineering Education (EED) will shape its practices and approach based on input from many of the engineering education stakeholders. This survey is directed towards potential and future students in order to help establish a student-centered program and curriculum within the OSU EED.

Targeted audience:

- Undergraduate students interested in Engineering Education graduate degrees
- Masters students interested in Engineering Education PhD
- Members of the Professional workforce seeking to expand knowledge or credentials
- Teachers, K12, and educational workforce seeking to expand knowledge or credentials
- Individuals interested in pursuing an education, certificate, or degree from the Department of Engineering Education at The Ohio State University

Consent Question: Do you allow the use of the survey for internal needs of The Ohio State University Department of Engineering Education?

Yes

No

Personal Background

What is your gender?

Male

Female

Other

I would prefer not to respond

What is your age?

Younger than 18

18-22

23-27

28-32

32+

I would prefer not to respond

Within which race do you identify. Check all that apply.

African American/Black

American Indian/Alaskan Native

Asian

European American/White

Hawaiian or Pacific Islander

Other

I would prefer not to respond

Are you Latino/a?

Yes

No

I would prefer not to respond

Are you a U.S. citizen?

Yes

No

I would prefer not to respond

I am from this region of the world:

North America

South America

Europe

Asia

Africa

Islandia

I am from this part of the country:

The Northeast

The Southeast

The West Coast

The MIdwest

The South

I am from outside the U.S.A.

Educational Background

Please describe your previous areas of study - answer as follows: (college/department/major) - if you have no previous areas of study answer N/A

Please describe your current areas of study - please answer as follows: (college/department/major) - if you are not currently enrolled answer N/A

What is the highest level of education you have completed?

0-2 years of undergraduate

3+ years of undergraduate

Bachelors degree

Masters

Currently I am a Ph.D. Student

Currently I am Ph.D. Candidate

Please select which most closely represents your average GPA in higher education:

Above 3.5

3 - 3.5

2.7 - 3

below 2.7

How would you describe your current university enrollment? Check all that apply.

Full-time

Part-time

Not enrolled

I am part of the professional workforce

What are your potential limitations for pursuing graduate education?

What is the highest level of education you are interested in pursuing? (please check all that apply).

Undergraduate Degree

Masters Degree

Doctorate

I would like to supplement my Degrees with Professional Certificates

Not Applicable

I would be interested in completing an online graduate degree with a distance learning format:

Strongly Agree

Agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Disagree

Strongly disagree

I am interested in pursuing full time graduate education:

Strongly Agree

Agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Disagree

Strongly disagree

During my graduate education I intend to have additional employment outside of the university (not including teaching, research, fellowships or other opportunities granted by the university)

Yes

No

Maybe

I do not know

Would you be interested in a compressed degree that would allow you to perform your professional responsibilities in parallel with degree completion? (example: Program for teachers with only a summer curriculum)

Yes

No

Engineering Education

I am aware that the field of Engineering Education exists, produces scholarly research, and produces Ph.D.s:

Strongly agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Strongly disagree

I am knowledgeable about the field of Engineering Education:

Strongly agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Strongly disagree

I have aspirations to contribute to the field Engineering Education:

Strongly agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Strongly disagree

I am interested in obtaining a degree from The Ohio State University Department of Engineering Education (EED):

Strongly agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Strongly disagree

I am interested in obtaining a degree in Engineering Education at a university other than The Ohio State University:

Yes

No

I am not sure

Which programs of Engineering Education are you interested in? Please list.

My Pursuit.

I would be interested in a engineering education degree – where I am evaluated on scholarly teaching effectiveness:

Strongly Agree

Agree

Neither Agree nor Disagree

Disagree

Strongly Disagree

I would be interested in an engineering education degree – where I am evaluated on research performance:

Strongly Agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

I would be interested in a balanced degree with both scholarly teaching and research activities being equally evaluated:

Strongly Agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

I would be interested in a certificate in Engineering Education that would increase my engineering education knowledge without providing a full degree:

Strongly Agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

Degree Dynamics

What number of required courses should constitute a Master's level understanding of material?

1-5

6-10

10+

Classes do not correlate to degree level understanding.

What amount of structure do you most prefer in a class?

I prefer being left alone to learn and do my classwork

I prefer independence from the instructor

I prefer strong guidance and support from instructors

I prefer working together with my classmates to learn

I have no preference regarding class structure

I prefer my engineering education classes to be on campus and in-person as opposed to online (virtual, distance, and/or synchronous/asynchronous):

Strongly Agree

Agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Disagree

Strongly disagree

What percentage of course credits towards a graduate degree in engineering education should be taught from within an engineering education department?

0 to less than 25%

25 to less than 50%

50% to less than 75%

More than 75%

I have no preference

I believe the following are important to my degree in engineering education

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
To Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs	○	○	○	○	○
To design, conduct, and critique research in engineering education	○	○	○	○	○
To demonstrate, value, and apply engineering expertise	○	○	○	○	○
To create, teach, and assess courses and curriculua	○	○	○	○	○
To identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits	○	○	○	○	○

What number of required courses should constitute a Ph.D. level understanding of material?

1-5

6-10

10+

Classes do not correlate to degree level understanding

Rank order how much weight the following requirements should carry with respect to engineering education degree attainment:

Course Credit

Impact within the field of Engineering Education

Qualifying/Candidacy Exams

Ph.D. Dissertation

Dissertation Proposal

Research Publications

Teaching Experience

Dissertation Oral Defense

Additional Degree Specialization (Globalization, Leadership, Motivation, etc.)

Are there any mechanisms/requirements for degree attainment not listed in the previous question that you feel are important to include? Please explain.

On a scale from 1-5 please use the sliding scale to rate the listed approaches to Research Advising and how each corresponds to academic success: (5 = corresponds very strongly, 0 = no correlation)

	0	1	2	3	4	5
Close advising in hands-on approach						
Balanced mentoring with hands-on and independent approach intertwined						
Advising that is						

hands-off and affords much independence and self directed research

On a scale from 0-5 to what extent are the listed activities important for EED professionals to acquire the skills necessary to succeed professionally?

	0	1	2	3	4	5
International Experience						
External Collaboration						
Industry internships						
Leadership Role within Professional Society						
Rotations within different OSU EED Research Laboratories						
Discipline Based Educational Research						
Grant Writing						
Post-Degree Employment Opportunities						
Availability of funds supporting degree completion						
Informal Partnerships						

I believe the following should count towards graduate degree completion in engineering education:

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Research	○	○	○	○	○
Engineering Education Courses	○	○	○	○	○
Conference Participation	○	○	○	○	○
Informal Learning Opportunities (outreach/engagement)	○	○	○	○	○
Research Publications	○	○	○	○	○
Dissemination of one's work	○	○	○	○	○
Professional Society Leadership Roles	○	○	○	○	○
Engineering Professional Practice	○	○	○	○	○
Classroom/Teaching Experience	○	○	○	○	○
Annual Review	○	○	○	○	○
International Experience	○	○	○	○	○

My Degree.

Please explain why you are interested in a Ph.D. within Engineering Education?

Which areas/specialization within EED do you anticipate being most critical to your future success: (Rate each independently)

	0	10	20	30	40	50	60	70	80	90	100
Graduate Studies											
Undergraduate Engineering											
First Year Engineering											
Problem/Project											

Based Learning

Engineering Leadership

Research Quality and Methods

Diversity and Inclusion

Engagement and Outreach

Engineering Ethics

Informal Learning

Qualitative Research Methods

Quantitative Research Methods

Mixed Methods Research

Evaluation and Assessment

Cognitive Studies

Engineering and Technical Communications

K12 Engineering Education

Faculty Development

Entrepreneurial Mindsets

Education Policy

Rank your interest in the specializations/areas within Engineering Education: (5 = strong interest, 0 = no interest)

	0	1	2	3	4	5
Graduate Studies						
Undergraduate Engineering						
First Year Engineering						
Problem/Project Based Learning						
Engineering Leadership						
Research Quality and Methods						
Diversity and Inclusion						
Engagement and Outreach						
Engineering Ethics						
Informal Learning						
Qualitative Research Methods						
Quantitative Research Methods						
Mixed Methods Research						
Evaluation and Assessment						
Cognitive Studies						
Engineering and Technical						

Communications

K12 Engineering Education

Faculty Development

Entrepreneurial Mindset

Education Policy

Please list any specializations/areas within Engineering Education not included on the list in which you are interested:

The Ohio State University and the OSU EED

What are the factors that make The Ohio State University most appealing? Please rank.

Geographical location in Columbus, Ohio

University size

University reputation

College of Engineering reputation

The fact that OSU is a comprehensive university

I am not familiar with The Ohio State University

Other

If you answered other to the previous question, please explain. If not, proceed with this question left blank.

Please briefly explain why The Ohio State University is appealing.

What are the factors that make The Ohio State University Department of Engineering Education (EED) most appealing? Please rank.

Newly established Department

The Departments setting within The Ohio State University

The EED leadership, faculty, and/or staff

The EED's Developent from the Engineering Education Innovation Center

I am not very familiar with the OSU EED

Other: Explain.

If you answered other to the previous question, please explain. If not, proceed with this question left blank.

Please briefly explain why The Ohio State University Engineering Education Department is appealing.

Closing

In this section please share any additional thoughts that you feel are important with respect to your needs and desires when considering enrolling in an engineering education department and that could be helpful to inform the development of the new engineering education graduate program.

Please let us know from where it was that you received this survey:

Email

etc.

etc.

If you would like follow up regarding your responses to this survey, please submit your email:

Thank you.

Thank you for participating in this survey.

Our website is: www.eed.osu.edu

If you are interested in being added to The Ohio State University Department of Engineering Education listserv please send an email to _____.

Click to write Choice 1

Click to write Choice 2

Click to write Choice 3

THE OHIO STATE UNIVERSITY

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Department of Teaching and Learning
333 Arps Hall, 1945 N. High Street
Columbus, OH 43210-0711
614-292-1257 Phone
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February 3, 2017

Dr. Monica Cox, Chair, Department of Engineering Education
Dr. Ann Christy, Engineering Education
The Ohio State University

Dear Drs. Cox and Christy,

This letter is to express the Department of Teaching and Learning's support of the Department of Engineering Education's (EED) proposed Ph. D. in Engineering Education program. We currently have an engineering education area within our STEM Ph. D. area of study and have been in collaboration with EED and its predecessor EEIC in its development and implementation. While our program has some learning experiences on post-secondary education, our program is mainly focused on preparing researchers to research in P-12 education settings. EED's proposed Ph. D. program expands the opportunities for OSU students to more fully include developing researchers to work in post-secondary engineering education settings. The program looks like a good complement to our program. We see a number of opportunities for students in either program to take courses in the other department

We look forward to continued collaboration with EED in both teaching and research.

Sincerely,

Dr. Christian Faltis
Chair, Department of Teaching and Learning

Budget for New Graduate Degree Programs

	Year 1	Year 2	Year 3	Year 4
Projected Enrollment				
Head-count full time				
Head-count part time				
Full Time Equivalent (FTE) enrollment				
Projected Program Income				
Tuition (paid by student or sponsor)				
Externally funded stipends, as applicable				
Expected state subsidy				
Other income (if applicable, describe in narrative section below)				
TOTAL PROJECTED PROGRAM INCOME:				
Program Expenses				
New Personnel • Faculty (e.g. tenure-track, clinical, professional) Full ____ Part Time ____ • Non-instruction (indicate role(s) in narrative section below) Full ____ Part time ____				
New facilities/building/space renovation (if applicable, describe in narrative section below)				
Tuition Scholarship Support (if applicable, describe in narrative section below)				
Stipend Support (if applicable, describe in narrative section below)				
Additional library resources (if applicable, describe in narrative section below)				
Additional technology or equipment needs (if applicable, describe in narrative section below)				
Other expenses (e.g., waived tuition and fees, travel, office supplies, accreditation costs) (if applicable, describe in narrative section below)				
TOTAL PROJECTED EXPENSE:				
NET				

Budget Narrative: *(Use narrative to provide additional information as needed based on responses above.)*