NEW GRADUATE CONCENTRATION PROPOSALS
ARIZONA STATE UNIVERSITY
GRADUATE COLLEGE

This form should be used for academic units wishing to propose a new concentration for existing graduate degrees.

A concentration is a subspecialty within a degree and major which reflects that the student has fulfilled a designated, specialized course of study which qualifies the student as having distinctive skills and training in one highly concentrated area of the major. Concentrations are formally-recognized educational designations (including the assignment of a university plan code for reporting/record-keeping purposes and appearance on the ASU transcript). Concentrations are to be distinguished from not formally recognized academic distinctions frequently referred to as “emphases,” “tracks,” “foci,” “options,” etc.

Submit the completed and signed (chairs, unit deans) proposal to the Office of Graduate Academic Programs. Mail code 1003 and electronic copies to ozel@asu.edu or Denise.Campbell@asu.edu

Please type.

Contact Name: Tirupalavanam G. Ganesh
Contact Phone: 480.727.9375
College/School/Division Name: Mary Lou Fulton College of Education

Academic Unit Name:
(or proposing faculty group for interdisciplinary proposals) Division of Curriculum and Instruction

Existing Graduate Degree and Major under which this concentration will be established:
Doctor of Philosophy – Curriculum and Instruction

Proposed Concentration Name:
Engineering Education

Do Not Fill in this information: Office Use Only
Plan Code:
CIP Code:

1. Overview

A. Provide a brief description of the new concentration (including the specific focus of the new concentration, relationship to other concentrations in this degree program, etc).

The concentration in Engineering Education within the Doctor of Philosophy (Ph.D.) in Curriculum and Instruction provides opportunities for interdisciplinary research in the teaching and learning of engineering, Pre K to College, by integrating research methods in learning theory, curriculum development, assessment, evaluation, and education with a particular understanding of engineering content and practice in a variety of contexts. Program mentors for this concentration will hail from the Mary Lou Fulton College of Education, and the Ira A. Fulton School of Engineering. An Engineering Education committee drawn from these colleges will oversee administration of the interdisciplinary Engineering Education concentration.

The goals of the proposed concentration are to prepare students: to critically analyze and conduct research in engineering education and to explore the art and science of learning engineering in Pre K to College. The proposed concentration will prepare students to take competitive positions in top-tier research institutions as exemplary scholars and teachers, and as leaders in engineering education in K-12 and higher-education settings in formal and informal learning contexts (e.g., school districts, schools, science centers, museums).

The concentration in Engineering Education will be an additional concentration area of the existing Interdisciplinary Ph.D. in Curriculum and Instruction. The Ph.D. in Curriculum and Instruction presently includes the following concentrations: Art Education, Curriculum Studies, Early Childhood, English Education, Language & Literacy, Mathematics Education, Physical Education Pedagogy, Science Education, and Special Education. The proposed concentration will enhance the existing set of concentrations and provide students the opportunity to explore learning theory, curriculum development, assessment and evaluation in engineering education.
The courses and learning experiences in the current concentrations in the Ph.D. in Curriculum and Instruction comprise seven areas for a total of a required minimum of eight-four (84) semester hours: Curriculum and Instruction Core Requirements [six (06) semester hours], Area of Concentration [thirty (30) semester hours], Cognate Study [twelve (12) semester hours], Inquiry and Analysis [fifteen (15) semester hours], Internships [six (06) semester hours], and Dissertation & Independent Research [fifteen (15) semester hours]. Each concentration requires a minimum of eighty-four (84) semester hours beyond the bachelor’s degree. The proposed concentration in Engineering Education is also designed to follow the same structure as other concentrations in the Ph.D. in Curriculum and Instruction.

Statement on relationship of the proposed Engineering Education concentration in the Ph.D. in Curriculum and Instruction to the proposed Engineering Education concentration in the Ph.D. in Mechanical Engineering, Ph.D. in Aerospace Engineering and other Ph.D. programs in the Ira A. Fulton School of Engineering (referred to hitherto as the Ph.D. in Engineering) that may add an Engineering Education concentration in the future:

The Engineering Education concentration in the Ph.D. in Curriculum and Instruction is expected to attract students who may want a focus on working in formal and informal Pre K-12 contexts or the preparation of Pre K-12 engineering educators including those interested in the field of Science, Technology, Engineering, and Mathematics education. Whereas, the Engineering Education concentration in the Ph.D. in Engineering is expected to attract students who may want a focus on engineering education in higher education settings as well as engineering education outreach and research in a variety of Pre K – College contexts.

2. Impact Assessment

A. Explain the unit’s need for the new concentration (e.g., market demand, research base, direction of the discipline, and interdisciplinary considerations). How will the new concentration complement the existing degree program, including enrollment, national ranking, etc?

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

The application of science and mathematics and the bringing together of multiple disciplines to solve human needs forms the core of engineering. Engineering has existed as long as humans have needs and it is fundamentally a human endeavor. The National Science Board (2007) stated that “The next generation of engineers will be challenged to find holistic solutions to population, energy, environment, food, water, terrorism, housing, health, and transportation problems….it is an exciting time to be in engineering.” This statement characterizes the interdisciplinary nature of the field, its importance to our citizenry, and the need to develop public intellectuals who can address the grand challenges of the 21st century.

The National Science Foundation’s Directorate for Engineering has developed Engineering Education Programs aimed at the following:

Engineering Education encourages the integration of engineering research and education to accelerate technological and educational innovation and improve the quality and diversity of engineering graduates entering the technical workforce. EEC encourages partnerships that infuse both research and education with new knowledge from multiple disciplines, take advantage of new understanding of how students learn, and focus on engineered systems. The objective is to graduate engineering leaders with a global outlook and the ability to adapt to the rapidly evolving technical environment in industry, academe, and society. It also supports the active involvement of K-12 teachers and community college faculty in engineering research in order to bring knowledge of engineering and technological innovation into their classrooms. (National Science Foundation, 2009).
The interdisciplinary Engineering Education concentration will permit Engineering and non-Engineering students to study and develop knowledge in learning theory, curriculum design, assessment, evaluation, teaching/facilitating learning, research methods in engineering education. Graduates will be prepared to effectively design Pre K- College engineering education programs, research and study the impact of engineering education programs, pursue funding for engineering education and research efforts, enhance the engineering education field informed by research on how people learn, the science and design of assessment and evaluation, facilitation of learning in varied contexts, and change engineering education in response to global challenges. The proposed concentration will complement existing concentrations in the Ph.D. in Curriculum and Instruction.

Over the last few months, five graduate students from the Ira A. Fulton School of Engineering have expressed interest in Engineering Education. Conversations among faculty and administrators in Engineering and Education indicate broad support in the development of the Engineering Education concentration. Recent interdisciplinary efforts from Education, Engineering, and the Sciences (e.g., D Baker, L Cozort, M. Eiser, T. Ganesh, S. Haag, S Krause, D. Meldrum, J. Middleton, D. Morell, V. Pizziconi, B. Ramakrishna, C. Roberts, F. Sloane, A. Tasooji, A. Weber) have resulted in sponsored projects in engineering education. These efforts have served to increase awareness and interest in Engineering Education at Arizona State University.

Nationally, we are aware of four prominent institutions that offer concentrations in Engineering Education at the Ph.D. level. They are:
- Virginia Tech: [http://www.enge.vt.edu/](http://www.enge.vt.edu/)
- Purdue University: [https://engineering.purdue.edu/ENE/Academics/Graduate/Doctorate/requirements](https://engineering.purdue.edu/ENE/Academics/Graduate/Doctorate/requirements)
- Utah State University: [http://www.engineering.usu.edu/htm/information/phd-engineering-education/](http://www.engineering.usu.edu/htm/information/phd-engineering-education/)
- Tufts University: [http://ase.tufts.edu/education/programs/research/MSTEphd.asp](http://ase.tufts.edu/education/programs/research/MSTEphd.asp)

It is important to note that Senay Purzer a 2008 Arizona State University graduate of the Ph.D. in Curriculum and Instruction with a Science Education concentration has joined the faculty at Purdue University’s School of Engineering Education, the unit that offers Engineering Education degrees. Purdue University and Virginia Tech were among the first to develop Engineering Education degree offerings. With a doctoral concentration in Engineering Education, Arizona State University will be among the top-tier institutions in the nation that prepare experts in Engineering Education, thereby influencing this emerging field. As there are very few national level graduate engineering-education programs, there is a large pool of prospective students available for recruitment.

The addition of the Engineering Education concentration can only help enhance national rankings of both the Mary Lou Fulton College of Education (ranked 16th among public universities in the 2009 U.S. News & World Report, America’s Best Graduate Schools of Education) and the Ira A. Fulton School of Engineering (ranked 25th among public universities in the 2009 U.S. News & World Report, America’s Best Graduate Schools of Engineering).

B. Please identify other related ASU programs and outline how the new concentration will complement these existing ASU programs? (If applicable, statements of support from potentially-affected academic unit administrators need to be included with this proposal submission.)

Engineering Education concentrations or degree programs are currently NOT available at ASU.

C. Is this an interdisciplinary concentration? If yes, please address the relationship of the proposed concentration to other existing degree programs and any parallel or similar concentrations in these degree programs.

A doctoral Engineering Education concentration is also being developed by the Ira A. Fulton School of Engineering for its Ph.D. in Mechanical Engineering and Aerospace Engineering. Those concentrations are envisioned as a pilot, with the idea that each Ph.D. degree in Engineering will add the Engineering Education concentration over the next few years. The Engineering Education concentration in Ira A. Fulton School of Engineering and the Mary Lou Fulton College of Education will be developed simultaneously creating a collaborative, interdisciplinary effort that will capitalize on the strengths and resources of each unit.

The Engineering Education concentration in the Ira A. Fulton School of Engineering will require the following core Engineering Education courses that will be administratively supported by the Mary Lou Fulton College of Education:

- ENE 701: Foundations of Engineering Education [Theories of Learning and Curriculum Issues as they relate to Engineering Education in various contexts]
- ENE 702: Assessment and Evaluation in Engineering Education [The Science and Design of,]
- ENE 703: Research Methods in Engineering Education
- ENE 704: Advanced Research Methods in Engineering Education
- ENE 780: Engineering Education Practicum: Applied Project [This course will include a research project where students design, implement, and conduct a research study in engineering education including the delivery of an engineering education effort, as a pilot to the dissertation.]

Note: ENE is a new prefix that is available for request at Arizona State University. A request to establish this prefix will be submitted in accordance with Arizona State University policies.
3. Academic Requirements and Curriculum

A. What are the total minimum hours required for the major and degree under which the proposed concentration will be established?

A total of eighty-four (84) semester hours are required for the program. Similar to the other concentrations in the Ph.D. in Curriculum and Instruction, the proposed Engineering Education concentration will comprise the following:

- Curriculum and Instruction Core Requirements [Six (06) semester hours] – Interdisciplinary Research Seminar in Curriculum and Instruction and Curriculum Theory and Practice) are required as the Curriculum and Instruction core.
- Area of Concentration [Thirty (30) semester hours] – Fifteen (15) semester hours pertaining to engineering education, engineering, technology, and related fields of science education, mathematics education, educational technology.
- Cognate Study [Twelve (12) semester hours] – to broaden the student's understanding of the conceptual base and issues underlying the study of curriculum and instruction. Cognate courses should thematically cohere, but can be drawn from a broad range of offerings from across the University's multiple disciplines.
- Inquiry and Analysis [Fifteen (15) semester hours] – advanced research design and data analysis in qualitative and quantitative research methods.
- Internships [Six (6) semester hours] – research and teaching internships to broaden experience and preparation in the field of engineering education.
- Dissertation & Independent Research [Fifteen (15) semester hours] – Three (03) semester of independent research and twelve (12) semester hours of dissertation research leading to the completion of an approved dissertation.

The proposed concentration is aimed at facilitating students towards original research in engineering education. Students will be encouraged to develop a strong interdisciplinary focus by drawing from the resources of the university and collaborating units. Students will defend a dissertation that describes an original contribution in engineering education with an emphasis on teaching, learning, curriculum design, assessment, and evaluation in engineering education within a chosen context (e.g., formal or informal Pre K-12 education, undergraduate education, interdisciplinary efforts in Pre K-College). Research results should be suitable for publication in a reputable journal. Students will be required to satisfy all qualifying and comprehensive examination requirements and abide by policies set forth by the Mary Lou Fulton College of Education and the Ph.D. in Curriculum and Instruction.

The proposed concentration includes close apprenticeships under the supervision of interdisciplinary faculty members drawn from across the collaborative units. Students will be required to spend one year as full-time students at Arizona State University.

Requirements

A strong background in engineering, OR in science, technology, or mathematics or any relevant combination thereof is required for this concentration. The following requirements can be completed in the first year of the program:

For a focus on college level engineering education, the equivalent of a master's degree in engineering, mathematics, science, or related field.

For a focus on high school engineering education, the equivalent of a major in engineering, mathematics, technology, or science courses, plus some graduate level courses as part of the program.

For a focus on middle school engineering education, at least two years of college engineering, mathematics, technology, or science courses.

In extraordinary cases, students may take these courses during their first year of studies. Students may be required to complete prerequisites in engineering, mathematics, science, technology, or in education.

Note: Those students who come with a bachelor’s degree will be required to take 30 credit hours of a combination of coursework and research related to the student’s dissertation research as deemed necessary by the student’s dissertation supervisory committee.
B. Please provide the admissions criteria for the proposed concentration. If they are identical to the admission criteria for the existing major and degree program under which this concentration will be established, you may attach a copy of these criteria as they appear in the Graduate Catalog, departmental website, or other source (please indicate source).

A minimum grade point average of 3.0 (on a 4.0 scale) is required for graduates of accredited United States institutions. ASU’s Graduate College is responsible for international grade point average interpretation. All applicants are required to take the general Graduate Record Examination (GRE); a subject-specific GRE is not required. Students who do not have English as their primary language are required to achieve minimum competencies as specified by the Graduate College.

Three letters of recommendation are required, using the format specified by Curriculum and Instruction. Letters of recommendation should address the applicant's professional experiences and potential for doctoral study.

All applicants are required to submit a statement of academic and career objectives and address the desire to pursue an engineering education concentration in the Ph.D. in Curriculum and Instruction (Letter of Intent), a curriculum vita, and a writing sample.

C. If the proposed concentration is part of a larger, interdisciplinary agenda, please provide additional admission information related to students who may enter with various academic backgrounds, including expected entry-level competencies.

Students applying to the Engineering Education Ph.D. concentration in the Ira A. Fulton School of Engineering must have an earned Bachelor’s or Master’s degree in an engineering field.

Students applying to the Engineering Education Ph.D. concentration in the Mary Lou Fulton College of Education must have an earned Bachelor’s or Master's degree in an engineering field, science (e.g., physics, chemistry), mathematics, or technology.

D. What knowledge, competencies, and skills (learning outcomes) should students have when they graduate from this proposed concentration program? Examples of program learning outcomes can be found at [http://www.asu.edu/oue/assessment.html](http://www.asu.edu/oue/assessment.html).

The following are possible learning outcomes. Students in the Engineering Education concentration in the Ph.D. in Curriculum and Instruction will be able to:

1. Conduct research in engineering education.
2. Conduct research and communicate research results publishable in a peer-reviewed journal or conference.
3. Effectively communicate the importance of engineering to a specific target audience (e.g., general public, Pre K-12 educators, educationists, college educators, etc.)
4. Develop and evaluate research designs in engineering education, including (but not limited to) Pre K-12 programs and university undergraduate engineering programs.
5. Effectively design and evaluate engineering courses at all levels.
6. Effectively teach Pre K-12 engineering / engineering education subjects, and university level or college engineering / engineering-education courses.
7. Apply their expertise to address critical issues related to engineering education.

E. How will students be assessed and evaluated in achieving the knowledge, competencies, and skills outlined in 3.D. above? Examples of assessment methods can be found at [http://www.asu.edu/oue/assessment.html](http://www.asu.edu/oue/assessment.html).

1. Student successfully completed and defended dissertation.
2. Student published at least one article in a reputable journal prior to graduation.
3. Student designed an engineering education research plan for a Pre K – College or other research-based program related to engineering education, separate from student’s dissertation.
4. Student successfully completed graduate-level coursework specific to curriculum as it relates to engineering education.
5. Student successfully completed graduate-level coursework specific to instruction as it relates to engineering education.
6. Student secures a professional position related to engineering education upon graduation.

F. Please provide the curricular structure for the proposed concentration.

Additionally, please ensure that all new required course proposals have been submitted to the Provost's office through the ACRES online course proposal submission system for approval before this concentration is put on the University Graduate Council and CAPC agendas.
Note: This is a sample curricular structure for concentration in Engineering Education Ph.D. in Curriculum and Instruction

### Required Core Courses for the Degree

<table>
<thead>
<tr>
<th>(Prefix &amp; Number)</th>
<th>(New Course?) Yes or No?</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCI 701 (Curriculum Theory and Practice)</td>
<td>No</td>
<td>3</td>
</tr>
<tr>
<td>DCI 702 (Interdisciplinary Research Seminar)</td>
<td>No</td>
<td>3</td>
</tr>
</tbody>
</table>

### Required Concentration Courses

<table>
<thead>
<tr>
<th>(Prefix &amp; Number)</th>
<th>(New Course?) Yes or No?</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENE 701 (Foundations of Engineering Education)</td>
<td>YES</td>
<td>3</td>
</tr>
<tr>
<td>ENE 702 (Assessment and Evaluation in Engineering Education)</td>
<td>YES</td>
<td>3</td>
</tr>
<tr>
<td>ENE 703 (Research Methods in Engineering Education)</td>
<td>YES</td>
<td>3</td>
</tr>
<tr>
<td>ENE 704 (Advanced Research Methods in Engineering Education)</td>
<td>YES</td>
<td>3</td>
</tr>
<tr>
<td>ENE 780 (Engineering Education Practicum: Applied Project)</td>
<td>YES</td>
<td>3</td>
</tr>
</tbody>
</table>

### Elective Courses

**Engineering Education Area of Concentration [fifteen (15) semester hours] — Seminar Series**

<table>
<thead>
<tr>
<th>(Prefix &amp; Number)</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>ENE 591 (Engineering Design as a Teaching Tool)</td>
<td>3</td>
</tr>
<tr>
<td>ENE 691 (Connecting Engineering to Science, Technology, and Mathematics)</td>
<td>3</td>
</tr>
<tr>
<td>ENE 791 (Engineering and Society)</td>
<td>3</td>
</tr>
<tr>
<td>ENE 791 (Curriculum and Pedagogy in Engineering Education)</td>
<td>3</td>
</tr>
<tr>
<td>ENE 791 (Design of Studio Courses for Engineering Education)</td>
<td>3</td>
</tr>
</tbody>
</table>

**Cognate Study [twelve (12) semester hours]**

<table>
<thead>
<tr>
<th>(Prefix &amp; Number)</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>DCI 791 (How People Learn)</td>
<td>3</td>
</tr>
<tr>
<td>DCI 791 (Cognition and Instruction)</td>
<td>3</td>
</tr>
<tr>
<td>ENE 691 (Evaluation of K-12 Engineering Education Programs)</td>
<td>3</td>
</tr>
<tr>
<td>PHS 594 (Electricity for Middle/Secondary Teachers)</td>
<td>3</td>
</tr>
</tbody>
</table>

**Inquiry and Analysis [fifteen (15) semester hours] [Note: Students may select from a large pool of courses in research methods under the guidance of the students’ program committee. The following is a potential “sample.”]**

<table>
<thead>
<tr>
<th>(Prefix &amp; Number)</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>COE 503 (Introduction to Qualitative Research in Education)</td>
<td>3</td>
</tr>
<tr>
<td>EDP 552 (Multiple Regression and Correlation Methods)</td>
<td>3</td>
</tr>
<tr>
<td>EDP 554 (Analysis of Variance Methods)</td>
<td>3</td>
</tr>
<tr>
<td>EDP 651 (Methods and Practices of Qualitative Research)</td>
<td>3</td>
</tr>
<tr>
<td>EDP 652 (Multivariate Procedures for Data Analysis)</td>
<td>3</td>
</tr>
</tbody>
</table>

**Internship [six (06) semester hours]**

<table>
<thead>
<tr>
<th>(Prefix &amp; Number)</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENE 784 (Research/Teaching Internship in Engineering Education)</td>
<td>6</td>
</tr>
</tbody>
</table>

**Culminating Experience (if applicable)**

<table>
<thead>
<tr>
<th>(Prefix &amp; Number)</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>N/A</td>
<td></td>
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</table>

**Research / Dissertation**

<table>
<thead>
<tr>
<th>(Prefix &amp; Number)</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENE 792 (Research)</td>
<td>03</td>
</tr>
<tr>
<td>ENE 792 (Dissertation)</td>
<td>12</td>
</tr>
</tbody>
</table>

**Total required credit hours**

84

G. Please describe the culminating experience(s) required for completion of the existing degree and major, and the proposed concentration (e.g., thesis, dissertation, comprehensive exams, capstone course(s), practicum, applied projects, etc.).
The Ph.D. in Curriculum and Instruction requires that: 1) students successfully pass a written and oral defense of a comprehensive exam and 2) students successfully write and pass an oral defense of a dissertation. The proposed concentration also requires that: 1) students successfully pass a written and oral defense of a comprehensive exam and 2) students successfully write and pass an oral defense of a dissertation; both with an emphasis in Engineering Education.

H. Please describe any other requirements for completion of the existing degree and major, and the proposed concentration (e.g., internships, foreign language skills, etc.).

The Ph.D. in Curriculum and Instruction requires that students complete six (06) semester hours of Internship in research and teaching. Similarly, the proposed Engineering Education concentration in the Ph.D. in Curriculum and Instruction will also require that students complete six (06) semester hours of Internship in research and teaching in Engineering Education. These research internships will be designed so students are mentored prior to their ENE 780 (Practicum) experience.

I. For interdisciplinary programs, additional sample curricular structures must be included as appendix items to this proposal relating to students with various academic backgrounds who may pursue the proposed concentration, including expected mastery of core competencies (e.g., course work, skills, and/or knowledge).

The Engineering Education Concentration Committee will review applications for the Engineering Education concentration in the Ph.D. in Curriculum and Instruction (and for the Ph.D. in Aerospace Engineering and the Ph.D. in Mechanical Engineering degrees) with attention to applicants’ prior course work, degrees earned, work and other learning experiences, against the applicants’ statement of intent and focus of study to determine what pre-requisites the applicant may need. This will be done on a case-by-case basis to ensure the students’ success in their chosen field of study.

For admission in the Engineering Education concentration, in the Ph.D. in Curriculum and Instruction, a strong background in engineering, OR in science, technology, or mathematics or any relevant combination thereof is required for this concentration. The following requirements can be completed in the first year of the program:
For a focus on college level engineering education, the equivalent of a master's degree in engineering, mathematics, technology, science, or related field.
For a focus on high school engineering education, the equivalent of a major in engineering, mathematics, technology, or science courses, plus some graduate level courses as part of the program.
For a focus on middle school engineering education, at least two years of college engineering, mathematics, technology, or science courses.
In extraordinary cases, students may take these courses during their first year of studies. Students may be required to complete prerequisites in engineering, mathematics, science, technology, or in education.

4. Administration and Resources

A. How will the proposed concentration be administered (including recommendations for admissions, student advisement, retention etc.)? Describe the administering body in detail, especially if the proposed concentration is part of a larger interdisciplinary agenda. How will the graduate support staff for this proposed concentration program be met?

Students enrolled in the Engineering Education concentration in the Ph.D. in Curriculum and Instruction must satisfy all University and the Division of Curriculum and Instruction admission criteria.

Members of the Engineering Education Concentration Committee drawn from Mary Lou Fulton College of Education, the Ira A. Fulton School of Engineering, and the College of Technology & Innovation are: Dale Baker, James Collofello, Lynn Cozort, Tirupalavanam Ganesh, Stephen Krause, James Middleton, Chell Roberts, Finbarr Sloane, Kyle Squires

The proposed concentration will have the same governance structure as the other concentrations in the Ph.D. in Curriculum and Instruction. A member of Engineering Education Concentration Committee will be elected by the faculty in this concentration to represent it in the Ph.D. in Curriculum and Instruction Executive Committee.

Application materials will be reviewed by the Engineering Education Concentration Committee and make recommendations for admissions to the appropriate unit Chairs. Admission recommendations will be submitted and reviewed by the Chair of the units that administer the Ph.D. degree where the Engineering Education concentration is offered (e.g., Mechanical Engineering and Aerospace Engineering in the Ira A. Fulton School of Engineering; Curriculum and Instruction in the Mary Lou Fulton School of Education).
Students will establish a five-person program committee comprising: a co-chair each from the Mary Lou Fulton College of Education; and the Ira A. Fulton School of Engineering or the College of Technology & Innovation, two graduate faculty members from Curriculum and Instruction, and one graduate faculty member from the Ira A. Fulton School of Engineering and/or the College of Technology & Innovation.

The program committee co-chairs will advise and mentor the students enrolled in the Engineering Education concentration in the Ph.D. in Curriculum and Instruction. Graduate support staff from both the Mary Lou Fulton College of Education and the Ira A. Fulton School of Engineering will work collaboratively to ensure student success.

However, administrative support for the proposed concentration will be housed in the Division of Curriculum and Instruction in the Mary Lou Fulton College of Education. We recognize that administrative staff in collaborating units in the Ira A. Fulton School of Engineering and the Mary Lou Fulton School of Education will need to be trained to provide the necessary support to students enrolled in the concentration.

B. How many students will be admitted immediately following final approval of the concentration? What are enrollment projections for the next three years?

It is expected that five (5) students will be admitted immediately following final approval of the proposed concentration. Projected enrollment is expected to increase by five (5) students each year for the first three years.

C. What are the resource implications for the proposed concentration, including any projected budget needs? For Doctoral students, how will the students be supported financially? Will new books, library holdings, equipment, laboratory space and/or personnel be required now or in the future? If multiple units/programs will collaborate in offering this concentration please discuss the resource contribution of each participating program. Letters of support must be included from all academic units that will commit resources to this concentration.

Students can be admitted the semester after the concentration is approved. The number of students in the Engineering Education concentration will be limited to the number that major faculty can mentor. The new ENE courses and seminars in Engineering Education will be developed jointly by a subgroup of the interdisciplinary faculty based on their expertise and interests. Initially, the five (5) ENE required core courses will be developed as soon as the concentration is approved. These courses will be taught in most cases collaboratively by Education and Engineering faculty. The special topics/seminar courses will be developed also, collaboratively on an ongoing basis and as the need arises.

Doctoral students will be supported by 25% TA positions in Education in combination with 25% TA positions in Engineering depending on funding availability; or by 50% research assistantships from either Education and/or Engineering, depending on funding availability. Doctoral students can also participate in sponsored research projects conducted by the faculty in this concentration. Support for students would be provided through graduate research assistantships associated to grants of the faculty involved in this concentration and are contingent upon funding availability and the need of involved faculty’s sponsored projects.

With respect to books and journals, the university library has an adequate collection in engineering and education. The University already carries the major journals in education and in engineering. The library has been very receptive in the past for suggestions of acquisitions, and the collection can be kept up-to-date, specifically as it relates to engineering education based on recommendations from the Engineering Education Concentration Committee.
D. Please list the primary faculty participants with regards to the proposed concentration.

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Area(s) of Specialization as they relate to proposed concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dale Baker</td>
<td>Professor, Science Education</td>
<td>Science, Gender, Equity, Assessment</td>
</tr>
<tr>
<td>James Collofello</td>
<td>Associate Dean and Professor, Engineering</td>
<td>Software Engineering</td>
</tr>
<tr>
<td>Lynn Cozort</td>
<td>Director, Graduate Admissions, Mechanical &amp; Aerospace Engineering</td>
<td>Engineering Education, Curriculum Studies, Learning Theory</td>
</tr>
<tr>
<td>Tirupalavanam Ganesh</td>
<td>Assistant Dean, Information Systems, Education</td>
<td>Engineering Education, Qualitative Research Methods, Curriculum Studies</td>
</tr>
<tr>
<td>Stephen Krause</td>
<td>Professor, Materials Science and Engineering</td>
<td>Engineering, Engineering Education</td>
</tr>
<tr>
<td>James Middleton</td>
<td>Professor, Mathematics Education</td>
<td>Mathematics, Learning Psychology, Curriculum Development</td>
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<tr>
<td>Chell Roberts</td>
<td>Chair &amp; Professor, Department of Engineering, College of Technology and Education</td>
<td>Engineering Design and Curriculum, Engineering Education, Industrial Engineering</td>
</tr>
<tr>
<td>Finbarr Sloane</td>
<td>Associate Dean for Research and Associate Professor, Mathematics Education</td>
<td>Mathematics, Research Methods in Education, Statistics</td>
</tr>
<tr>
<td>Kyle Squires</td>
<td>Chair and Professor, Department of Mechanical and Aerospace Engineering</td>
<td>Computational Science and Engineering, Fluid Mechanics</td>
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</table>
5. Additional Material — Please attach any additional information that you feel relates to the proposed concentration. (Please label accordingly, i.e., Appendix or Attachment A, B, etc.)

**Approvals**
(if the proposal submission involves multiple units, please include letters of support from those units)

<table>
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<tr>
<th>DEPARTMENT CHAIR</th>
<th>Josephine Marsh, Interim Director, Division of Curriculum and Instruction</th>
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**Please note:** Proposals for new concentrations also require the review and recommendation of approval from the University Graduate Council, Curriculum and Academic Programs Committee (CAPC), the Academic Senate (Information item only), and the Office of the Provost before they can be put into operation.

The final approval notification will come from the Office of the Provost.

GF0908E-92
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To:     Maria Allison, Dean, Graduate College

From:  George Hynd, Dean, Mary Lou Fulton College of Education

Date:  March 25, 2009

Re:    Establishment of the Engineering Education Concentration as parallel
c oncentrations in the PhD in Engineering and in the PhD in Curriculum &
       Instruction Degree Programs

I am writing this memo to support the establishment of the Engineering Education
concentration as parallel concentration in the Ira A. Fulton School of Engineering
and the Mary Lou Fulton College of Education.

The establishment of the Engineering Education concentration will require the
offering of ENE courses. While the Mary Lou Fulton College of Education will
schedule these courses; I wanted to note that the Engineering and Education
colleges will collaboratively administer the Engineering Education concentration.
An “Engineering Education” faculty group drawn from the two colleges will be
established. Staff from both colleges will collaboratively to support students in the
Engineering Education concentration.

I give my unequivocal support of this collaborative effort to establish the
Engineering Education parallel concentration in both the PhD in Engineering and
Curriculum & Instruction.

Cc: Deirdre Meldrum, Dean, Ira A. Fulton School of Engineering
MEMORANDUM

To: Maria Allison, Dean, Graduate College

From: Paul C. Johnson, Executive Dean, Ira A. Fulton School of Engineering

Date: March 25, 2009

Re: Establishment of the Engineering Education Concentration as parallel concentrations in the PhD in Engineering and in the PhD in Curriculum & Instruction Degree Programs

I am writing this memo to support the establishment of the Engineering Education concentration as parallel concentration in the Ira A. Fulton School of Engineering and the Mary Lou Fulton College of Education.

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I give my support of this collaborative effort to establish the Engineering Education parallel concentration in the PhD programs in Mechanical Engineering, Aerospace Engineering, and Curriculum & Instruction.

Cc: George Hynd, Dean, Mary Lou Fulton College of Education