EDUC 656: Teacher Engineering Education: Universal Design for Learning
(3 credit hours)
University of Indianapolis Fall I 2022

September 15 – November 3

Meeting Location: Online Asynchronous
Instructor: Dr. John W. Somers

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Required Text: There is NO required text for this course. Readings will be provided.

Please see EDUC 656 on Brightspace.

Description of course:
This course is designed for K-12 teachers who seek to understand the need to build more engineering capacity in K-12 education, expand practice by integrating engineering principles & projects into content areas, and design experiences through an inclusive and accessible lens. Teachers will be introduced to multimodal composition and inclusive design to create more accessible books, games, and classroom materials. Modules are designed to enable teachers to flexibly apply the projects in their classrooms or other formal/informal contexts. The modules will range from the use of physical computing devices to the design of cranky cardboard contraptions. Constructs of access, equity, and social justice will be threaded throughout the course as well as inquiry-based pedagogy to enact projects. All engineering devices for the course will be shipped to the participants. Participants will be requested to provide basic materials such as cardboard, scissors, tape, etc.

Course Outcomes: Students completing this course will:

- Understand the need to build engineering capacity in K-12 education.
- Apply the engineering design process and practices
- Gain knowledge of multiliteracies, multimodal composition and inclusive design
- Apply inquiry-based pedagogy and instructional strategies
- Design a service learning/community-based project to enhance access, equity, and social justice in engineering education

- Recognize the need to develop engineering identity, empathy, and curiosity in themselves and students
- Become familiar with the Social Cognitive Theory of Career Development

Teaching Methods: This course involves a combination of mini-lectures, active learning strategies, videos, hands-on activities and discussion.

Assignment and Assessment Types:
Students will engage in various assignments such as course readings, viewing instructional videos, creating projects, and presenting classroom work and outcomes.

Assessments: Students will develop lesson plans, submit written reflections on course readings and activities, maintain an engineering journal, and create a digital portfolio.

Classroom Format: Online Asynchronous

School of Education Mission Statement
The School of Education prepares transformative educators who work alongside communities to learn deeply and disrupt educational and social injustice.
• We believe effective educators practice and promote self-efficacy, creativity, and curiosity to create inclusive, relationship-driven, connected communities of learners.
• We believe effective educators advocate for social justice and equitable learning opportunities in order for all students to achieve their highest potential.
• We believe effective educators are servant leaders who positively impact the future of education in our society.

Conceptual Framework and Statement of Professional Disposition:
Teachers are decision-makers who employ their talents, knowledge, and skills who…
1. Combine content and pedagogical knowledge and tools of inquiry to develop meaningful and accessible learning progressions.
2. Create inclusive learning environments where educators and learners work together to construct meaningful learning.
3. Construct high quality assessments to inform practice and provide meaningful feedback to learners.
4. Collaborate and communicate with learners, P-12 educators, and community members to create a community of practice.
5. Critically reflect on the process of teaching and learning to promote insight and action.
6. Cause positive change through leadership and advocacy.

University Learning Goals
The four university-wide learning goals are:
1. Critical Thinking – Participants will employ the use of reason in order to make a judgments on best practices for their own students in the classroom.
2. Creativity – Participants will develop or apply something new, innovative, imaginative, or divergent through the design of their inquiry-based learning unit.
3. Social Responsibility – Participants will develop the self, moral, consciousness, and responsiveness to others. Participants will design a project that helps the community and/or develops empathy in others around a societal issue.
4. Performance – Participants will present their projects through an engaging mixed-media platform.

Expectations: Students are expected to participate in class activities by engaging with the instructor and other students in discussion, asking questions, and cooperating with others in hands-on activities and apply content to the classroom.

Attendance: Students are expected to be on time to and attend all class periods. Students who miss class for valid reasons (e.g., sickness, funerals, jury duty, and university-sanctioned activities) should inform the instructor via email prior to the absence.
Statement ADA: If you have a disability that may have some impact on your work in this class and for which you may require accommodations, please inform me immediately so that your learning needs may be met appropriately. Students with a disability must register with the Services for Students with Disabilities office (SSD) in Schwitzer Center 206 (317)-788-6153 / www.uindy.edu/ssd) for disability verification and determination of reasonable academic accommodations. You are responsible for initiating arrangements for accommodations for tests and other assignments in collaboration with the SSD and the faculty.

Academic Integrity and Academic Misconduct: The students, faculty, and administrators of the University of Indianapolis commit themselves to the highest level of ethical conduct in academic affairs. The University of Indianapolis, therefore, adopts regulations concerning Academic Misconduct to safeguard the academic integrity of the institution. Academic Misconduct includes, but is not limited to, the following circumstances (A) Cheating, (B) Fabrication, (C) Plagiarism, (D) Interference, (E) Violation of Course Rules, (F) Facilitating Academic Dishonesty, and (G) Abuse of Confidentiality. For a full statement of the policy refer to the University of Indianapolis Student Handbook, Section I, Academic Information.

Class Participation Rubric:

	Exemplary (90%-100%)	Proficient (80%-90%)	Developing (70%-80%)	Unacceptable (>70%)
Frequency of participation in class	Student initiates contributions more than once in each recitation.	Student initiates contribution once in each recitation.	Student initiates contribution at least in half of the recitations	Student does not initiate contribution & needs instructor to solicit input.
Quality of comments	Comments always insightful & constructive; uses appropriate terminology. Comments balanced between general impressions, opinions & specific, thoughtful criticisms or contributions.	Comments mostly insightful & constructive; mostly uses appropriate terminology. Occasionally comments are too general or not relevant to the discussion.	Comments are sometimes constructive, with occasional signs of insight. Student does not use appropriate terminology; comments not always relevant to the discussion.	Comments are uninformative, lacking in appropriate terminology. Heavy reliance on opinion & personal taste, e.g., "I love it", "I hate it", "It's bad" etc.
Listening Skills	Student listens attentively when others present materials, perspectives, as indicated by comments that build on others' remarks, i.e., student hears what others say & contributes to the dialogue.	Student is mostly attentive when others present ideas, materials, as indicated by comments that reflect & build on others' remarks. Occasionally needs encouragement or reminder from T.A of focus of comment.	Student is often inattentive and needs reminder of focus of class. Occasionally makes disruptive comments while others are speaking.	Does not listen to others; regularly talks while others speak or does not pay attention while others speak; detracts from discussion; sleeps, etc.

Service Learning/Community-based Project: The project overview and rationale is taken from the TeachEngineering site. We will engage in a brainstorming activity to create a number of ideas and eventually

narrow one down that you will conduct with your students. The ideal project will be authentic – one with a real client --- and result in the development of a prototype. There are several worksheets and attachments on the TeachEngineering site that you may use to plan the project. You are welcome to use the PBL templates that you used in EDUC 654. It will work to get you started. Many ideas for projects can be found on TeachEngineering. We will discuss more about this project in class with additional resources on Brightspace.

Service Learning/Community-based Project: see TeachEngineering for more details of this project
This unit describes a general approach to guiding students to complete service-based engineering design projects, with specific examples provided in detail as associated activities. With your class, brainstorm ideas for engineering designs that benefit your community or a specific person in your community. Then, guided by the steps of the engineering design process, have students research to understand background science and math, meet their client to understand the problem, and create, test and improve prototype devices. Note that service-based projects often take more time to prepare, especially if you arrange for a real client. However, the authors notice that students of both genders and all ethnicities tend to respond with more enthusiasm and interest to altruistic projects.
Engineering Connection
The real world is teeming with opportunities for people, including engineers, to apply their expertise to helping others and improving our general and specific quality of life. This is the very nature of engineering. The work of engineers directly impacts the lives of people in their communities (shelters, playgrounds, water treatment plants, heating and cooling devices, bridges, medical devices, etc.). The associated activity examples engage students in designing prototype devices to help the authors' local community members, but the same approach applies more broadly to teams following the steps of the engineering design process as they come up with solutions to service-based engineering challenges that benefit specific people in their communities and/or society at large.
Unit Overview
This project works well as a semester-long project in a high school engineering class or elective course. Arrange for a real-world client or create a hypothetical service-based opportunity (perhaps using one of the associated activities). Then, have students follow the steps of the engineering design process while they attempt to solve the open-ended problem, with the main objective to build working prototypes.
For further suggestions and support materials, refer to the Tips for Leading Service-Based Engineering Design Projects and other attachments.

Assignment Schedule:
Assignments will be due every Wednesday at 5pm. New assignments will be assigned every Wednesday at 5pm. All assignments will be graded on a point scale. Grades will be determined on an earned/possible basic point formula.

Assessments:

Class Preparation Activities (warm-ups, readings, reflections):	150 points
In-Class Activities/assignments:	210 points
Engineering Service Learning Project	100 points
Engineering Journal	100 points
Total	560 points

All projects must be completed to receive a grade for the course.

Policy on Late Assignments: Assignments will be turned in by the announced due dates and times. Assignments are to be submitted online using BrightSpace, unless otherwise noted. I will

accept assignments after the due date, but late work will receive 50%of the allocated points. I will not accept any late work for points after the eighth day and zero points will be given.

Grading:
Final grades will be calculated according to the following scale:

A 100 – 95 %	A- 94 – 90 %	
B+ 87 – 89 %	B 84– 86 %	B- 80 – 83 %
C+ 77 – 79 %	C 74 – 76 %	C- 70 – 73 %
D+ 67 – 69 %	D 64 – 66 %	D- 60 – 63 %
F 60 and below		

Assignment is due on the date listed.

Weeks	Topic(s)
#1 September 15 5:45 – 8:20 pm Zoom	Course Overview What is Engineering? Why Teach Engineering? Engineering Design Cycle Engineering Design Notebook TeachEngineering: Project Reading #1 Reflection & Discussion
#2 September 22 5:45 – 8:20 pm Zoom	Engineering with a Purpose Classroom Hands-on Applications Engineering Design Notebook Service Learning/Community Project Reading #2 Reflection & Discussion
#3 September 29 5:45 – 8:20 pm Zoom	Classroom Hands-on Applications Engineering Design Notebook Service Learning/Community Project Reading #3 Reflection & Discussion
#4 October 06 5:45 – 8:20 pm Zoom	Classroom Hands-on Applications Engineering Design Notebook Service Learning/Community Project Reading #4 Reflection & Discussion
#5 October 13 5:45 – 8:20 pm Zoom	Classroom Hands-on Applications Engineering Design Notebook Service Learning/Community Project Reading #5 Reflection & Discussion
#6 October 20 5:45 – 8:20 pm Zoom	Classroom Hands-on Applications Engineering Design Notebook Service Learning/Community Project Reading #6 Reflection & Discussion

#7 October 27 5:45 – 8:20 pm Zoom	Classroom Hands-on Applications Engineering Design Notebook Service Learning/Community Project Reading #7 Reflection & Discussion
#8 November 3 5:45 – 8:20 pm Zoom	Service Learning/Community Project Presentation Classroom Hands-on Applications Engineering Design Notebook Course feedback and evaluation