EER 602: Theoretical and Conceptual Frameworks for Engineering Education Research

Winter 2024 Syllabus

Instructor
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Course Meetings
This course meets once each week on Wednesdays from 9:30 am-12:20 pm in Room 224 GFL.

Course Website
The course Canvas site will contain the following items, among others:
- Announcements
- Required and supplementary reading material
- Assignments

Sign in with your UM ID and select the EER 602 tab.

Office Hours
Office hours for this course are by appointment. I am happy to schedule a meeting with you. Please email me with your availability and I will be happy to find a time that we can meet.

Course Description
In-depth examination of relevant theoretical and conceptual frameworks from education, psychology, and other disciplines; focus on how the theories apply to engineering education research (EER) and can be used to guide research and advance knowledge and practice (3 credits).

Course Goals
Students will be able to describe foundational aspects of a collection of theoretical and conceptual frameworks used in engineering education research. The frameworks included in the course were chosen to provide exposure to a variety of frameworks used in the field; however, there are many others from which an EER scholar can leverage in their work. Thus, another central course goal is for students to be able to describe how theoretical and conceptual frameworks are used in engineering education research to

facilitate students in applying frameworks in their own engineering education research, whether or not that framework was discussed during the course.

Textbook
No textbook is required for this course. A list of course readings follows in the syllabus and pdfs are posted on Canvas.

Course Structure
Throughout the course, we will engage in foundational readings of a diversity of frameworks used in EER as well as scholarship in which these frameworks are applied in EER settings across disciplines and from pre-engineering, undergraduate engineering, graduate engineering, and engineering professional practice. Each week, we will unpack the core elements of a theoretical or conceptual framework and examine its use in the literature. To guide us through these activities, we will follow a similar structure before and during class each week.

Assignments
Weekly
1. Individually read articles each week, answer reading questions, and submit responses on Canvas.
2. Document your group discussions in class and upload notes to Canvas.
3. Attend and participate in class each week: You are expected to come to class prepared for discussions to support your own and others' learning. Please respect others' opinions, listen carefully when others are speaking, and provide rationale for your own statements. If you will miss class for an unavoidable reason, please email in advance. Please communicate with me as early as possible so that I can help you work out a plan if you have to miss class.

Once
1. Lead large group discussion: Summarize articles, ask guiding questions, and lead a discussion with the group based on the articles.
2. Complete peer reviews of two draft papers written by your classmates.
3. Final project: a) Select a framework used in EER not included as part of the course and find a foundational paper and two articles that leveraged the framework. b) Present the framework and application papers in class using a one pager that you create that summarizes the framework and how it is used in EER scholarship. c) Write a paper summarizing the framework and the application articles. More details on the final project are provided in a separate document.

All class assignments will be posted on Canvas. In case of an emergency or needed flexibility, please email me and I will help you determine a plan for moving forward.

Grading
Overall course grades will be based on all assignments, as listed in the table below.

Item	% of Final Grade
Weekly individual question responses	30
Weekly group question responses	5
Weekly attendance and participation	10
Discussion leadership	5
Peer reviews	10
Framework presentation	10
Framework paper	30

NameCoach and Course Directory
As part of attendance for Week 2, we will ask that all members of the course complete an entry in our course directory (shared on the first day of class), which includes creating an entry in UM's NameCoach if you do not already have a profile. Your course directory entry may be updated as needed during the semester.

Course Policies (in alphabetical order)
Accommodations
I am committed to assisting students with disabilities requiring course accommodations that are registered Services for Students with Disabilities (SSD). Please discuss these accommodations with us as early in the semester as possible. **If you are not registered with SSD but have a circumstance or condition that affects your ability to participate and learn in the class, please speak with me so I can best support you this semester.**

The University of Michigan recognizes disability as an integral part of diversity and is committed to creating an inclusive and equitable educational environment for students with disabilities. Students who are experiencing a disability-related barrier should contact Services for Students with Disabilities https://ssd.umich.edu/; 734-763-3000 or ssdoffice@umich.edu). For students who are connected with SSD, accommodation requests can be made in Accommodate. If you have any questions or concerns please contact your SSD Coordinator or visit SSD's Current Student webpage.

Discussion Guidelines
This course is discussion based. I ask that all students review the following discussion guidelines (the first eight points of which are from MIT Learning Lab) to support respectful and productive discussions in class:
- Listen respectfully, without interrupting.
- Listen actively and with an ear to understanding others' views. (Don't just think about what you are going to say while someone else is talking.)
- Criticize ideas, not individuals. We all can learn something from each other, even if your views don't necessarily align.

- Avoid blame, speculation, and inflammatory language.
- Allow everyone the chance to speak.
- Avoid assumptions about any member of the class or generalizations about social groups. Do not ask individuals to speak for their (perceived) social group.
- We are accountable for our words and their impact.
- Personal information that comes up in the conversation should be kept confidential.

- Follow best practices for inclusive language when talking about groups (refer to Inclusive Language resources below).
- Assume good intentions and correct others as you are comfortable when they make a mistake.

I invite students to suggest changes and additions to these guidelines for our work together this semester. We will discuss this the first day of class.

Diversity and Inclusion
I value all students regardless of background and am committed to fostering a climate of inclusion in the classroom. The diversity of participants in this course is a valuable source of ideas, problem solving strategies, and creativity. If you feel that your or any other student's contribution is not being valued for any reason, please speak with me directly.

Engagement in Class Sessions
Since the course is discussion based, it is important for us to engage together to unpack the readings to support your learning. Thus, you are expected to attend class in person each week. If you anticipate challenges related to attending a specific session, we can discuss what options make the most sense for your circumstances on a case-by-case basis. If there are extenuating circumstances that inhibit your attendance for a class session, please let me know so we can figure out how to best support your course progress.

Extensions Policy
As with attendance, I recognize that life events and responsibilities outside of this class can impact a student's (or instructor's) ability to meet certain timelines and due dates. The main goal of this course is for students to achieve the learning objectives in the syllabus. Our best work and learning are not achieved when we are rushed or overloaded, and this applies to both students and instructors. For this reason, I have developed a flexible assignment extension policy. If you have a known conflict (e.g., travel to an academic conference) with a class session or due date, please talk to me in advance so we can develop a plan to make up the work or agree to a deadline extension.

In parallel with recognizing the importance of occasional extensions, I also recognize the importance of students not becoming overloaded at a later time in the semester due to increasing numbers of assignments (for this class as well as other classes a student is enrolled in) overlapping from extensions. For this reason, **proposed new due dates should typically be within one week of the original due date.** Further, there is also consideration of final course grade submission guidelines, which may limit extensions (without requesting an incomplete) for end of semester assignments. Please talk with me so we can formulate a plan.

Extension requests should be sent to the instructor BEFORE the due date. The request should include (1) an explanation of why the extension is needed (excluding any information you are not comfortable sharing), (2) the proposed new due date, and (3) a plan and timeline for how the student will meet the new due date. Extension approvals may require the student to meet with the instructor to discuss and refine the proposed plan. I intend to grant all extension requests that meet these guidelines.

Extensions and makeup assignments will be granted for extenuating circumstances in accordance with university policy. Please contact the CARE Center for assistance (as they can assist with these requests for ALL your courses if you experience an extenuating circumstance). I am happy to assist you in contacting the CARE Center and other university resources if you have questions or need any assistance.

Assignments submitted after the due date without an approved request for an extension will incur a 20% penalty if submitted within 24 hours, a 50% penalty if submitted within 48 hours, with no credit assigned after 48 hours. **I do not anticipate needing this policy, because I intend to grant extensions as described above provided students or teams follow the guidelines.** Assignments that are submitted after the new due date is set (from an approved extension) will also follow the policy of 20% penalty if submitted within 24 hours, a 50% penalty if submitted within 48 hours, with no credit assigned after 48 hours.

Honor Code
The College of Engineering (CoE) Honor Code is a statement of ethical standards by which the faculty and students of the CoE conduct themselves. All community members are expected to read and abide by the Honor Code. Unfamiliarity with the Honor Code is not an excuse for not following the standards outlined by the code.

Inclusive Language
In writing and in discussion, I ask that students regularly review the following resources about inclusive language. We will also discuss this topic in class.
APA Inclusive Language Guidelines
AHEAD Statement on Language

Mental Health and Well-being
Diminished mental health, including significant stress, mood changes, excessive worry, substance/alcohol abuse, or problems with eating and/or sleeping can interfere with optimal academic performance, social development, and emotional wellbeing. If you or someone you know experiences any of the above mental health concerns, we strongly encourage you to contact or visit any of the University's resources provided below. **Getting help is a smart and courageous thing to do – for yourself and for those who care about you.**[1]

As an instructor, student wellness is very important to me (and is one of my areas of research!). I encourage students to reach out to me if I can provide support as well as to access resources at the University of Michigan. What you share will remain confidential unless it requires mandatory reporting; there are limited situations in which sexual assault is disclosed or I am concerned regarding ongoing danger to you or others in which I may be required to report some information through official channels. I will always be transparent and work with you to determine how to do this best while respecting your privacy.

If you are experiencing stress, anxiety, depression, abuse, etc. and think you may need assistance, counseling and psychological services (CAPS) are freely available through the University. [Follow this link for more information and for a complete list of health and wellness resources and services provided by the College of Engineering's CARE Center.](#)

Stress and anxiety are exacerbated by the continued uncertainties associated with the COVID-19 global pandemic. The College of Engineering has resources specifically designed to support students through this especially difficult time. I am willing to contact the CARE Center on behalf of any student (with their consent) if that is helpful to the student. Please don't hesitate to reach out to me!

Campus has a number of important (and free!) resources for students. Please refer to [this document](#), which includes some that I am aware of.

Name, Pronunciation, and Pronouns
It is important to me that, as part of our commitment as a course community to engage with all members of our community with respect, that we use the names, pronunciation, and pronouns of our community members correctly. Please include your name and pronouns as you wish to be addressed in your Course Directory entry, and please complete the UM NameCoach profile that will also be linked in our Canvas site. Please review the Course Directory and listen to our community members' name pronunciations. As we are all human, we all make mistakes. Per our course discussion guidelines, I ask that we all bring good intentions with our language and interactions and assume good intentions of others.

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[1] This statement was adapted from the [University of Illinois CS Mental Health Committee](#). I acknowledge their excellent work to support and advocate for student mental health in higher education.

Religious Observances and other conflicts
The University of Michigan, as an institution, does not observe religious holidays. However, every reasonable effort will be made to help students avoid negative academic consequences when their religious or other obligations conflict with academic requirements. **If you find that a presentation or assignment due date conflicts with a religious observance or any other commitment, please let the instructor know as soon as possible.** You will be given every opportunity to make up the work without penalty, unless it interferes unreasonably with course delivery in accordance with university policy. Read the University's full policy here.

Course Schedule and Readings

Notes on Readings: Weekly readings include foundational or summative paper(s) describing the framework (indicated by *), and application papers in which scholars leveraged the framework.

Date	Session: Topic	Pre-class readings and Other Deliverables
1/10	1: Defining Frameworks	***For our first session, the following readings are posted for reference, they do not need to be read before the first class session.*** 1. Ravitch, S. M., & Riggan, M. (2016). *Reason & rigor: How conceptual frameworks guide research*. Sage Publications. Chapter 1 2. Anfara Jr, V. A., & Mertz, N. T. (Eds.). (2014). *Theoretical frameworks in qualitative research*. Sage publications. Chapter 1 3. Magana, A. J. (2022). The role of frameworks in engineering education research. *Journal of Engineering Education*, 111(1), 9-13.
1/17	2: Applying Frameworks & Guest Speaker	**** Deliverable: Complete your entry in the course directory with NameCoach recording** 1. *Dawson, K. M., O'Brien, K. E., & Beehr, T. A. (2016). The role of hindrance stressors in the job demand–control–support model of occupational stress: A proposed theory revision. *Journal of Organizational Behavior, 37,* 397–415. 2. *Tudge, J., & Rosa, E. M. (2019). Bronfenbrenner's ecological theory. *The Encyclopedia of Child and Adolescent Development*, 1-11. 3. Mirabelli, J. F., Cromley, J. G., & Jensen, K. J. (2024, in review). The inherency of doctoral stressors: A longitudinal mixed methods study characterizing stressors experienced in doctoral engineering student workplaces. Submitted to *Studies in Engineering Education*.
1/24	3: Student involvement theory	1. *Astin, A. W. (1999). Student involvement: A developmental theory for higher education. *Journal of College Student Development*, 40(5), 518–529.

		2. *1 page excerpt (Section II) from: Chen, H. L., Lattuca, L. R., & Hamilton, E. R. (2008). Conceptualizing engagement: Contributions of faculty to student engagement in engineering. *Journal of Engineering Education*, *97*(3), 339-353. 3. Georges, S. V., & Chen, H. (2018). International Student Involvement: Leading away from home. *Journal of Leadership Education*, *17*(4), 17-34. 4. Komarek, R., Bielefeldt, A. R., & Knight, D. W. (2021). Influences of engineering students' college experiences on leadership skill assurance. *International Journal of Engineering Education*, 37(5), 1454-1465.
1/31	4: Situated learning theory	1. *Lave, J. (1991). Chapter 4 Situating Learning in Communities of Practice. *Perspectives on Socially Shared Cognition*, *2*, 63–82. 2. *Duguid, P. Prologue: Community of Practice Then and Now; Lave, J. Epilogue: Situated Learning and Changing Practice. In Amin, A., & Roberts, J. (Eds.). (2008). *Community, economic creativity, and organization*. OUP Oxford. 3. Ayar, M. C., & Yalvac, B. (2022). An ethnographic study of an engineering community: Mentoring as a tacit rule and its implications for how people learn. *Journal of Engineering Education*, *111*(2), 400-419. 4. Dannels, D. (2000). Learning to Be Professional. *Journal of Business and Technical Communication*, *14*(1), 5–37.
2/7	5: Self-efficacy theory	1. *Bandura, A. (1994). Self-Efficacy. In *Encyclopedia of human behavior* (Vol. 4, pp. 71–81). New York: Academic Press. 2. Perkins Coppola, M. (2019). Preparing preservice elementary teachers to teach engineering: Impact on self-efficacy and outcome expectancy. *School Science and Mathematics*, *119*(3), 161-170. 5. Verdín, D., & Godwin, A. (2018). Exploring Latina first-generation college students' multiple identities, self-efficacy, and institutional integration to inform

		achievement in engineering. *Journal of Women and Minorities in Science and Engineering*, *24*(3), 261-290.
2/14	6: Social cognitive career theory	** *Deliverable: Identify your <u>framework</u> for the Framework Paper and find a foundational source* 1. *Lent, R., Brown, S., & Hackett, G. (2002). Social Cognitive Career Theory. In Duane Brown and Associates (Ed.), *Career Choice and Development* (pp. 255–311). San Francisco: Jossey-Bass. 2. *Brown, S. D., & Lent, R. W. (2019). Social cognitive career theory at 25: Progress in studying the domain satisfaction and career self-management models. *Journal of Career Assessment*, *27*(4), 563-578. 3. Henderson, T. S., Shoemaker, K. A., & Lattuca, L. R. (2022). Career calculus: Assessing the psychological cost of pursuing an engineering career. *Journal of Engineering Education*, *111*(4), 770-791. 4. Mozahem, N., Ghanem, C. M., Hamieh, F., & Shoujaa, R. E. (2019). Women in engineering: A qualitative investigation of the contextual support and barriers to their career choice. In *Women's Studies International Forum*, 74, 127-136.
2/21	7: Expectancy value theory	***Deliverable: Identify two <u>application papers</u> for the Framework Paper* 1. *Eccles, J. S. (2005). Subjective task value and the Eccles et al. model of achievement-related choices. In A. J. Elliot & C. S. Dweck (Eds.), *Handbook of Competence and Motivation* (pp. 105–121). New York, NY: Guilford Publications. 2. Lee, W., Lutz, B., Matusovich, H., & Bhaduri, S. (2021). Student perceptions of learning about diversity and its place in engineering classrooms in the United States. *International Journal of Engineering Education*, 37(1), 147-162. 5. Mosyjowski, E. A., Daly, S. R., Peters, D. L., Skerlos, S. J., & Baker, A. B. (2017). Engineering PhD returners and direct-pathway students: Comparing expectancy, value, and cost. *Journal of Engineering Education*, *106*, 639–676.

3/6	8: Multiple identity theory	1. *Gee, J. (2001). Identity as an analytical lens for research in education. *Review of Research in Education*, *25*, 99–125. 2. Capobianco, B. M., French, B. F., & Diefes-Dux, H. A. (2012). Engineering identity development among pre-adolescent learners. *Journal of Engineering Education*, *101*(4), 698-716. 3. Rodriguez, S. L., Doran, E. E., Friedensen, R. E., Martínez-Podolsky, E., & Hengesteg, P. S. (2020). Inclusion & marginalization: How perceptions of design thinking pedagogy influence computer, electrical, and software engineering identity. *International Journal of Education in Mathematics, Science and Technology*, *8*(4), 304-317.
3/13	9: Critical race theory	***Deliverable: Draft of Framework Paper** 1. * Ladson-Billings, G. (2021). Critical race theory—What it is not!. In *Handbook of critical race theory in education* (pp. 32-43). Routledge. 2. Blosser, E. (2020). An examination of Black women's experiences in undergraduate engineering on a primarily white campus: Considering institutional strategies for change. *Journal of Engineering Education*, *109*(1), 52-71. 1. DeCuir-Gunby, J. T., Long-Mitchell, L. A., & Grant, C. (2009). The emotionality of women professors of color in engineering: A critical race theory and critical race feminism perspective. In P. A. Schutz & M. Zembylas (Eds.), *Advances in Teacher Emotion Research: The Impact on Teachers' Lives* (pp. 323–342). New York: Springer.
3/20	10: Peer Review	***Deliverable: Peer Review** In-class small group meetings with peer reviews
3/27	11: Community cultural wealth framework	1. * Yosso, T. J. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. *Race ethnicity and education*, *8*(1), 69-91. 2. Braun, D. C., Gormally, C., & Clark, M. D. (2017). The deaf mentoring survey: A community cultural wealth framework for measuring mentoring effectiveness with

		underrepresented students. *CBE—Life Sciences Education*, *16*(1), ar10. 3. Tolbert Smith, D. (2022). "They are here to support me": Community cultural wealth assets and precollege experiences of undergraduate Black men in engineering. *Journal of Engineering Education*, *111*(4), 750-769.
4/3	12: Funds of knowledge framework	1. *González, N., Wyman, L., & O'connor, B. H. (2011). The past, present, and future of "Funds of Knowledge". *A Companion to the Anthropology of Education*, 479-494. 2. Smith, J. M., & Lucena, J. C. (2016). Invisible innovators: How low-income, first-generation students use their funds of knowledge to belong in engineering. *Engineering Studies*, *8*(1), 1-26. 4. Svihla, V., Chen, Y., & Kang, S. P. (2022). A funds of knowledge approach to developing engineering students' design problem framing skills. *Journal of Engineering Education*, *111*(2), 308-337.
4/10	13: Positionality and Quality	1. Martin, J. P., Desing, R., & Borrego, M. (2022). Positionality statements are just the tip of the iceberg: Moving towards a reflexive process. *Journal of Women and Minorities in Science and Engineering*, *28*(4). 2. Secules, S., McCall, C., Mejia, J. A., Beebe, C., Masters, A. S., L. Sánchez-Peña, M., & Svyantek, M. (2021). Positionality practices and dimensions of impact on equity research: A collaborative inquiry and call to the community. *Journal of Engineering Education*, *110*(1), 19-43. 3. Hampton, C., Reeping, D., & Ozkan, D. S. (2021). Positionality statements in engineering education research: A look at the hand that guides the methodological tools. *Studies in Engineering Education*, *1*(2). 4. Walther, J., Sochacka, N. W., & Kellam, N. N. (2013). Quality in interpretive engineering education research: Reflections on an example study. *Journal of engineering education*, *102*(4), 626-659.

4/17	14: Framework presentations	***Deliverables: Framework Presentation; Framework Paper*** Round Table: Student Presentations of Frameworks Group Activity: How are frameworks used in EER?

—In order to best support the class as a whole and be responsive to unforeseen events, accommodating schedules of guest speakers, etc. the instructor may update this syllabus and schedule as necessary. Please be sure you are accessing the latest version of the syllabus on the course website.—