



ENE 503 ENGINEERING EDUCATION INQUIRY

Fall 2022

CRN: 64386

Credit: 3 credit hours

This 16-week course follows the standard Purdue Academic Calendar

- **Class Start Date** August 24, 2021
- **Class End Date** December 7, 2021
- **Academic Calendar** <https://www.purdue.edu/registrar/calendars/2022-23-Academic-Calendar.html>

Course Modality: ☒ Face-to-Face ☐ Asynchronous online

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COURSE INSTRUCTOR & SUPPORT TEAM

Your Instructor

Prof. Şenay Purzer, Professor, School of Engineering Education (she/her/hers)

- Email: purzer@purdue.edu
- Office: Wang 4545
- Office Hours: Wednesdays and by appointment
- Role: Instructor
- A little about me: I am passionate about design and study engineering design reasoning, decision-making, and creativity in undergraduate and K-12 education. I've been at Purdue since 2009.

Other Members of the Instructional Team:

Prof. Wei Zakharov, Associate Professor & Engineering Information Specialist
Libraries & School of Information Studies (she/her/hers)

- Email: wzakharov@purdue.edu
- Role: Libraries Faculty Liaison to ENE (provides expertise on databases, search strategies, and systematic literature review)
- Office: WALC 3053 P
- Office Hours: First and third Thursday of every month from 2pm-3pm or by appointment. WebEx Link: <https://purdue.webex.com/meet/liu31>
- Library Guide: <https://guides.lib.purdue.edu/ene503>
- A little about me: My research centers around online learning, technology enhanced learning in STEM, and information and data literacy education. I received Ph.D in Learning, Design and Technology at Purdue in 2012. My research centers around online learning, and information and data literacy education.

Siqing Wei, Graduate Teaching Fellow, School of Engineering Education (he/him/他),

- Email: wei118@purdue.edu
- Role: A graduate student who has taken this course before. He will be available to help you with systematic literature review project
- Office: WANG 3500
- Office Hours: by appointment
- A little about me: Siqing Wei received BS and MS in Electrical Engineering from Purdue University. His research interests center on three major research topics: teamwork, cultural diversity, and international student experiences. As a research assistant, he investigates how the cultural diversity of team members impacts the team dynamics and outcomes, particularly for international students. In addition, he also works on many research-to-practice projects to enhance educational technology usage in engineering classrooms and educational research. I am happy to help with quantitative research methods besides systematized literature review.

Cristian Vargas-Ordóñez, Graduate Teaching Fellow, School of Engineering Education (he/él)

- Email: cvargaso@purdue.edu
- Office: Wang 3500

- Office Hours: by appointment
- Role: a graduate student who has taken this course before. I will be available to help you with systematic literature review project
- A little about me: I research integrated education to foster non-utilitarian values in engineering education (i.e., compassion) that promote and protect human rights. I focus on the inter and transdisciplinary integration of art and engineering.

COURSE DESCRIPTION

This graduate level course on inquiry aims to introduce students to research in engineering education. This course covers a survey of educational research methodologies as well as strategies for locating, documenting, and critically reading literature for the purpose of crafting arguments from evidence.

In this course, you will get exposed to professional and ethical conduct of research through readings, videos, discussions and assignments; practice synthesizing research and crafting arguments from evidence while recognizing multiple paradigmatic lenses (i.e., post-positivist, constructivist, and pragmatic); and explore a repertoire of qualitative, quantitative, mixed research methodologies used in engineering education.

This course is one of the required core courses for the graduate degree in Engineering Education at Purdue University.

COURSE GOALS AND LEARNING OBJECTIVES

The course is an introduction to engineering education research and its main goal is to introduce students to engineering education research. The course is designed in alignment with the following goals and objectives:

1. Engage in professional and ethical conduct of engineering education research
 - a. Explain how research is a **form of argumentation** with claims and evidence
 - b. Recognize **ethical considerations** in various aspects of research such as its design and arguments.
 - c. Use appropriate **library resources** to locate literature and reports
 - d. Acknowledge and document citations and references in APA format
 - e. Engage in **scholarly critique** (of work written by scholars or peers) in a constructive and professional manner
2. Craft arguments from evidence
 - a. Write succinct yet complete **titles, abstracts, and keywords**
 - b. Identify **variations in arguments** associated with different sections of a research article
 - c. Synthesize **existing literature** in a systematic way to craft arguments on the state of research in a specific area
 - d. Describe differences between narrative literature reviews and **systematic literature reviews**
 - e. Present ideas and arguments succinctly and clearly through writing
3. Explore repertoire of research methodologies used in engineering education
 - a. Explain the need for **different methodologies**

- b. Compare a range of research methodologies by explaining **variations in research methods** (sampling, data collection, analysis) and purpose
- c. Identify different **philosophical foundations** associated with specific research methodologies
- d. Explain why it is important to acknowledge the researcher positionalities in research
- e. Articulate the role of theoretical and conceptual **frameworks** in research
- f. Distinguish **quality criteria** associated with qualitative and quantitative research methods

HOW THIS COURSE IS ORGANIZED

The course is organized under three modules:

- Module 1: Introduction to research and systematic reviews
- Module 2: Conducting and evaluating research: Qualitative methods
- Module 3: Conducting and evaluating research: Quantitative methods

A typical week of activities will look like the following:

(1) READ/PREPARE: Reading assigned book chapters and journal articles, listening to video/audio materials, and making connections across these materials.

(2) ENGAGE: (a) Completing assignments and posting on the Discussion Board or Assignment Dropbox. (b) Engaging with others by reviewing and responding to their submissions.

(3) REFLECT: Reviewing and reflecting on lessons learned and feedback received

GRADING SCALE, ASSIGNMENTS & GRADE DISTRIBUTION

Grading Scale and Grade Cutoffs

A: 93% A-: 90% B+: 87% B: 83% B-: 80% C+: 77% C: 73% C-: 70% D: 60% F<60%

Expectations for Engagement

Written assignments should be 12pt Times New Roman, 1 inch margins, double-spaced, and submitted electronically as a pdf. Use American Psychological Association (APA) format for citations and all references. See the APA book and/or APA guidelines on the Purdue Online Writing Lab resource page found at <http://owl.english.purdue.edu/owl/resource/560/01>

In the course, it is expected that you will come to class prepared to discuss all the readings and actively engage in a respectful discussion each week. Such discussion includes:

- Allowing everyone a chance to speak
- Listening respectfully and actively
- Critiquing ideas, not individuals
- Committing to learning

Semester Timeline and Deadlines

Please refer to the "Course Map" for a detailed semester timeline (see page 11).

Course Assignments & Expectations

Assignment	Assignment Details	Grade %
IRB certification (Individual)	<p>A requirement of the Graduate College is completion of the following Collaborative Institutional Training Initiative (CITI) training. Hence, you are expected to complete the following training:</p> <ul style="list-style-type: none"> ○ Responsible Conduct of Research (RCR) ○ Social and Behavior Research Investigators and Key Personnel (Basic Course) ○ https://www.irb.purdue.edu/training/ <p>If you have completed these courses before, please submit your existing certificate and inform me.</p>	4%
Insights (Individual) due Tues. at midnight*	<p>You will share your insights (in a paragraph or with a visual) about the weekly “guiding questions” or “research methods” covered that week. As you share your insights, include 2-3 in-text citations that help make explicit connections to course materials and discussions.</p> <p><i>*Insights are not assigned on weeks when there is a major assignment due.</i></p>	12%
Peer Dialogue (Individual) due Thurs. at midnight*	<p>You will share your thoughts and reactions in response to your peers’ insights. Make sure to practice collegial discourse, build associations across insights, but also engage in critical thinking.</p>	12%
Systematized Literature Review (SLR) Project (Individual)	<p>There will be one major assignment (systematized literature review), with 6 milestones spread throughout the entire course. The assignment will be on an engineering education topic of your choosing and involve reading, analyzing, and synthesizing published literature to form an argument answering a research question on the current state of research. This assignment has multiple components:</p> <ul style="list-style-type: none"> • 5-minute idea pitch (introduce topic, initial search numbers, plans to delimit search and justification) • 3 draft papers (two for peer & one for faculty feedback) and one final systematized literature review (SLR) paper <p>In your drafts, you will include a cover letter and “response to reviewers.”</p>	51%
Peer Review & Feedback	<p>You will provide feedback to your peers on their SLR project (one for pitch, two for drafts). These reviews must be</p> <ul style="list-style-type: none"> • on-time, • collegial/constructive, and • reflective of your critical thinking. 	21%

TEXT, VIDEO, AND OTHER RESOURCES

MINIMUM TECHNOLOGY REQUIREMENTS

You will need a strong, reliable Internet connection on a daily basis to meet the requirements for this class. Students are expected to use Brightspace and all of its features to be successful in this course.

Microsoft Office 365: Available free to all Purdue students

<https://www.itap.purdue.edu/shopping/software/product/office365.html>

Text Resources on Research and Crafting Arguments

(The electronic versions of these books are available free through Purdue libraries)

1. Booth, W. C., Colomb, G.G., Williams, J. M., Bizup, J., & Fitzgerald, W.T. (2016). *The craft of research* (4th edition). Chicago, IL: University of Chicago Press.
2. Lichtman, M. (2017). *Qualitative research for the social sciences*. Thousand Oaks, CA: Sage Publications.
3. Muijs, D. (2011). *Doing quantitative research in education: with SPSS* (2nd edition). Thousand Oaks, CA: Sage Publications.

Resources on Ethical Conduct of Research

1. American Educational Research Association (2016). Standards for research conduct. Retrieved from <http://www.aera.net/Publications/Standards-for-Research-Conduct>
2. American Psychological Association (2010). *Publication manual of the American Psychological Association* (7th edition). Washington, DC: American Psychological Association.
3. American Psychological Association (2016). Publication practices & responsible authorship. Retrieved from <http://www.apa.org/research/responsible/publication>
4. American Psychological Association (2021). Peer review. Retrieved from <https://www.apa.org/pubs/journals/resources/peer-review>
5. Purdue Human Subjects Research Protection. <https://www.irb.purdue.edu/index.php>

Assigned Journal Articles

- Berdanier, C. G. P. (2021). Linking current and prospective engineering graduate students' writing attitudes with rhetorical writing patterns. *Journal of Engineering Education*, 110(1), 207–229. <https://doi.org/10.1002/jee.20368>
- Boklage, A., Coley, B., & Kellam, N. (2019). Understanding engineering educators' pedagogical transformations through the Hero's Journey. *European Journal of Engineering Education*, 44(6), 923–938.
- Borrego, M. (2007). Conceptual difficulties experienced by trained engineers learning educational research methods. *Journal of Engineering Education*, 96(2), 91–102.
- Borrego, M., Foster, M.J. and 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. DOI 10.1002/jee.20069
- Douglas, K. A., & Purzer, S. (2015). Validity: Meaning and relevancy in assessment for engineering education research. *Journal of Engineering Education*, 104(2), 108–118.
- Dringenberg, E., & Purzer, S. (2018). Experiences of First-Year Engineering Students Working on Ill-Structured Problems in Teams. *Journal of Engineering Education*, 107(3), 442–467. <https://doi.org/10.1002/jee.20220>

- Ehsan, H., Rispoli, M., Lory, C., & Gregori, E. (2018). A systematic review of STEM instruction with students with autism spectrum disorders. *Review Journal of Autism and Developmental Disorders*, 5(4), 327-348.
- Grant, M. J., & Booth, A. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Information & Libraries Journal*, 26(2), 91-108.
- Holly Jr, J. (2021). Equitable Pre-College Engineering Education: Teaching with Racism in Mind. *Journal of Pre-College Engineering Education Research*, 11(1), Article 9. <https://doi.org/10.7771/2157-9288.1282>
- Kellam, N., & Cirell, A. M. (2018). Quality considerations in qualitative inquiry: Expanding our understandings for the broader dissemination of qualitative research. *Journal of Engineering Education*, 107(3), 355-361.
- Kirn, A., & Benson, L. (2018). Engineering Students' Perceptions of Problem Solving and Their Future. *Journal of Engineering Education*, 107(1), 87-112. <https://doi.org/10.1002/jee.20190>
- Mackenzie, N., & Knipe, S. (2006). Research dilemmas: Paradigms, methods and methodology. *Issues in Educational Research*, 16(2), 193-205. <http://www.iier.org.au/iier16/mackenzie.html>
- Marton, F. (1986). Phenomenography—a research approach to investigating different understandings of reality. *Journal of Thought*, 21(3), 28-49.
- Menekse, M., Stump, G. S., Krause, S., & Chi, M. T. H. (2013). Differentiated Overt Learning Activities for Effective Instruction in Engineering Classrooms. *Journal of Engineering Education*, 102(3), 346-374. <https://doi.org/10.1002/jee.20021>
- Mentzer, N. (2014). High School Student Information Access and Engineering Design Performance. *Journal of Pre-College Engineering Education Research*, 4(1), Article 4. <https://doi.org/10.7771/2157-9288.1074>
- Montfort, D., Brown, S., & Shinew, D. (2014). The Personal Epistemologies of Civil Engineering Faculty. *Journal of Engineering Education* (Washington, D.C.), 103(3), 388-416. <https://doi.org/10.1002/jee.20050>
- Simmons, D. R., & Martin, J. P. (2017). Shaping autonomous decision makers: Familial influence on persisting first generation college engineering students. *Journal of Women and Minorities in Science and Engineering*, 23(1), 53-71.
- Svihla, V., Chen, Y., & Kang, S. (2022). A funds of knowledge approach to developing engineering students' design problem framing skills. *Journal of Engineering Education*, 111(2), 308- 337. <https://doi.org/10.1002/jee.20445>
- Tolbert Smith, D., Jones, T., & Cardella, M. E. (2022). A Narrative Investigation of Black Familial Capital that Supports Engineering Engagement of Middle-School-Aged Youth. *Journal of Pre-College Engineering Education Research*, 12(1), Article 2. <https://doi.org/10.7771/2157-9288.1308>.
- Verdín, D., Godwin, A., Kirn, A., Benson, L., & Potvin, G. (2018). Engineering women's attitudes and goals in choosing disciplines with above and below average female representation. *Social Sciences*, 7(3), 44.
- Walther, J., Sochacka, N.W., Benson, L.C., Bumbaco, A.E., Kellam, N., Pawley, A.L. and Phillips, C.M.L. (2017), Qualitative Research Quality: A Collaborative Inquiry Across Multiple Methodological Perspectives. *Journal of Engineering Education*, 106(3), 398-430. <https://doi-org/10.1002/jee.20170>
- Wilson-Lopez, A., Strong, A. R., Hartman, C. M., Garlick, J., Washburn, K. H., Minichiello, A., Weingart, S., & Acosta-Feliz, J. (2020). A systematic review of argumentation related to the engineering-designed world. *Journal of Engineering Education*, 109(2), 281- 306. <https://doi-org/10.1002/jee.20318>

Wilson-Lopez, A., Mejia, J. A., Hasbún, I. M., & Kasun, G. S. (2016). Latina/o adolescents' funds of knowledge related to engineering. *Journal of Engineering Education*, 105(2), 278–311. <https://doi.org/10.1002/jee.20117>

POLICIES

Academic Honesty

Academic honesty requires that students do not cheat, or knowingly assist another to do so. Other unacceptable behavior includes plagiarism, which is the submitting of someone else's work as your own, and the unauthorized access to or changing of grades or examinations. Faculty consider the submitting/performing of essentially the same single piece of work for credit in different classes to be dishonest unless all faculty members involved have agreed, in advance, to the specific situation.

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information is submitted the greater the opportunity for the university to investigate the concern. More details are available on our course BrightSpace under University Policies.

Accessibility/Accommodations

If you are a person with special circumstances that you believe will affect your class performance (e.g., visual, hearing or learning disabilities or language differences) please let us know if we can make appropriate accommodations. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247. The Adaptive Services website is located at: <http://www.purdue.edu/odos/adpro/>.

Use of Copyrighted Materials

Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally.

Notes taken in class are, however, generally considered to be “derivative works” of the instructor’s presentations and materials, and they are thus subject to the instructor’s copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor (this statement includes websites like web pages like Course Hero, Chegg, or Quizlet). To obtain permission to sell or barter notes, the individual wishing to sell or barter the notes must be registered in the course or must be an approved visitor to the class. Course instructors may choose to grant or not grant such permission at their own discretion, and may require a review of the notes prior to their being sold or bartered. If they do grant such permission, they may revoke it at any time, if they so choose.

Attendance/Engagement

I encourage you to be as engaged in the course as possible. Please inform the instructor ahead of time (if possible) for any unexpected issues impacting your engagement.

Academic Guidance in the Event a Student is Quarantined/Isolated

Importantly, if you find yourself too sick to progress in the course, notify me via email or Brightspace. We will make arrangements based on your particular situation. The Office of the Dean of Students (odos@purdue.edu) is also available to support you should this situation occur.

Grief Absence Policy for Students

Purdue University recognizes that a time of bereavement is very difficult for a student. The University therefore provides the following rights to students facing the loss of a family member through the Grief Absence Policy for Students (GAPS). GAPS Policy: Students will be excused for funeral leave and given the opportunity to earn equivalent credit and to demonstrate evidence of meeting the learning outcomes for missed assignments or assessments in the event of the death of a member of the student's family.

Missed or Late Work

Late work will result in late or no feedback. All assignments are given formative feedback and graded on completion except for the final SLR paper, which will receive a final summative evaluation and grade. All late work major assignment submissions will receive a zero unless prior discussion is had with the instructor and permission for a late submission is given.

Student Wellbeing

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack or TaskHuman. Sign in and find information and tools at your fingertips, available to you at any time. If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm. If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Violent Behavior Policy

Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote

educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity.

Emergencies

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

Nondiscrimination

Purdue University is committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.

Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and local laws, regulations and orders and in conformance with the procedures and limitations as set forth in Executive Memorandum No. D-1, which provides specific contractual rights and remedies. Any student who believes they have been discriminated against may visit www.purdue.edu/report-hate to submit a complaint to the Office of Institutional Equity. Information may be reported anonymously.

Guidance Regarding Protect Purdue

Any student who has substantial reason to believe that another person is threatening the safety of others by not complying with Protect Purdue protocols is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights and the Violent Behavior Policy under University Resources in Brightspace.

VERSIONS & CORRECTIONS

There might be revisions to this initial plan as the instructors see necessary to ensure the best educational opportunities for all students. Any changes will be highlighted in the syllabus in red text or with yellow highlights and will be summarized below this section.