EACJ5007/ELEC5100: Introduction to Engineering Education Research

Term: Fall 2025

Introduction

Engineering education research is a relatively new but growing discipline of research. Its focus is on the study and research of the learning around engineering, in particular (but not restricted to) the education of engineering student in universities. Topics within the course include, theoretical background information on learning; case studies on particular learning situations: including laboratories and project work; social and professional aspects of engineering education; plus related research methods. Besides engineering the field brings in research into learning, psychology and social sciences.

Instructor: Alan Steele

Contact: alan.steele@carleton.ca, Room ME4144

Delivery: In-person

Website: Course Brightspace page

Meeting time: 8:35 am - 9:55 am TR, 3rd Sept. 2025 - 5th Dec. 2025 (in Southam Hall 506)

Aims

The aim of this course is to introduce and explore some of the current ideas and areas of study in engineering education research. This involves developing an understanding of the theoretical underpinnings to engineering education. As well as linking the theory to studies in different areas of engineering education.

Objectives

Students will be able to:

- Explain and discuss different aspects of the theoretical background to engineering education
- Apply the theoretical ideas and reflect on to their own engineering education experience.
- Conduct an examination of current engineering education research in an area of the student's interest, via a small project. This includes:
  - Analyze recent literature. Compare and discuss ideas of approaches.
  - Presenting their key findings of their own investigation.
  - Create a report with an evaluation and reflection on the findings.

Weekly Schedule

This is an approximate schedule, there may be slight adjustments in times or topic content.

Week	Week Starting	Topic	Details
0	1st Sept	Introduction to engineering education	Introduction to the course and the research area of engineering.
1	8th Sept	Taxonomies	What is a taxonomy and why use one. Types of taxonomy. Bloom, Anderson, SOLO, Fink
2	15th Sept	Learning models and learning styles	Kolb, Felder and Silverman, Schön. Learning approaches; surface, deep and strategic.
3	22nd Sept	Theoretical frameworks for learning	Frameworks include: Behaviourist, Cognitivist and Situated. Understanding the perspectives in reported studies.
4	29th Sept	Examples of engineering education. Preparation for case studies	A series of case studies will be investigated by students and presented in the class (in addition to their own mini-project). Reports can be from observation in the class, an analysis of a paper or a combination of those.
5	6th Oct	Scholarship of Teaching and Learning (SOTL) and Engineering Education Research	What is SOTL and how does it fit with engineering education research? Human ethics for research.
6	13th Oct	Case studies: Classrooms	Examples could be: looking at peer instruction; development of classroom instruction in the age of mobile devices; online ‘classrooms’; problem analysis sessions. co-operative learning.
	20th Oct	No classes. Fall break.	
7	27th Oct	Case Studies: Laboratories	Examples could be: Types of laboratory experience; benefits of individual to group laboratories; the laboratory environment; remote access and virtual laboratories.
8	3rd Nov	Case Studies: Project work	Examples could be: capstone projects; first year projects; mini-projects within a course; group project issues and concerns; evaluation.
9	10th Nov	Case Studies: Social and professional aspects of engineering education	Ethical issues; Indigenous aspects; accreditation; diversity.
10	17th Nov	Assessment	Consideration of the area of assessment.
11	24th Nov	Student presentations and discussion	Mini-projects would have been decided by week 6. This is either oral or poster demonstration of the findings.
12	1st Dec	Future areas of developments and summary.	Selection of some current and potential future direction in engineering education. Summary of the course.

Important Dates in the Term

These **selected** dates are included here for convenience and you should always check https://calendar.carleton.ca/academicyear/ incase of any changes

- 1st *September 2025*. Statutory holiday. University closed.
- 2nd *September 2025*. Academic orientation (undergraduate and graduate students).
  - Orientation for new Teaching Assistants.
  - All new students are expected to be on campus. Class and laboratory preparations, departmental introductions for students, and other academic preparation activities will be held.
- *3rd September 2025.* Fall term begins. Full fall, early fall and fall/winter classes begin.
- *16th September 2025*. Last day for registration and course changes (including auditing) in full fall, late fall, and fall/winter courses.
  - Graduate students who have not electronically submitted their final thesis copy to Graduate Studies will not be eligible to graduate in fall 2025 and must register for the fall 2025 term.
- *30th September 2025*. Last day to withdraw from full fall term and fall/winter courses with a full fee adjustment.
- 13*th October 2025.* Statutory holiday. University closed.
- *20th-24th October 2025*. Fall break, no classes.
- *15th November 2025*. Last day to withdraw from full fall and late fall term courses.
  - Last day to request Formal Examination Accommodation Forms for December examinations to the Paul Menton Centre for Students with Disabilities. Note that it may not be possible to fulfil accommodation requests received after the specified deadlines.
- *21st November 2025*. Last day for summative tests or examinations, or formative tests or examinations totaling more than 15% of the final grade, in full fall term or fall/winter undergraduate courses, before the official December final examination period (see examination regulations in the Academic Regulations of the University section of the Undergraduate Calendar/General Regulations of the Graduate Calendar).
- *28th November 2025*. Last day for graduate students to submit their supervisor-approved thesis, in examinable form to the department.
- *30th November 2025*. Last day for receipt of applications from potential winter (February) graduates.
- 5*th December 2025.* Fall term ends.
  - Last day of full fall and late fall term classes.
  - Classes follow a Monday schedule.
  - Last day for take home examinations to be assigned, with the exception of those conforming to the examination regulations in the Academic Regulations of the University section of the Undergraduate Calendar/General Regulations of the Graduate Calendar.
  - Last day that can be specified by an instructor as a due date for term work for full and late fall courses.
- 6*th-7th December 2025*. No classes or examinations take place.

- *8th-20th December 2025*. Final examinations in full fall and late fall courses and mid-term examinations in fall/winter courses will be held. Examinations are normally held all seven days of the week.
- *24th December 2025 through 2nd January 2026 inclusive*. University closed.

Office Hours

I will be available for office hours at **11am until noon on Tuesday and 2pm to 3pm Wednesday** (room ME4144). This could be adjusted if we see it beneficial to adjust this. If you need to meet at an alternative time then please contact me for an appointment. An online Zoom meeting is possible too, email me to arrange such a meeting.

Texts and Learning Resources (including cost)

Students are not required to purchase textbooks or other learning materials for this course.

There is no set text that you have to buy but there will be references made to various books and papers. Wherever possible I will try and select material that is available electronically through Carleton's Library website or is openly available. As this course looks at an active area of research and there is a project required then there will be a significant amount of searching in the literature by you. Again, the University's Library website will allow access to many sources of information.
Two resources that are worth noting are:
• "Cambridge Handbook of Engineering Education Research", A. Johri and B. Olds (eds.), Cambridge University Press, (2014).
• "Experiential Learning in Engineering Education", Alan L. Steele, CRC Press, (2023).
These are available through the library.

Assessment

The set and due dates are approximate and may vary depending on factors like progress and workload. (The week number relate to the schedule above, so week 1 starts 11th Sept and there is a week 0).

1. Assignment 1: Value 10% [Set week 1. Due week 3]
2. Assignment 2: Theory 15% [Set week 4. Due week 6]
3. Participation in Discussions 15% [Set week 1. Evidence collection due week 12]
4. Project 60% (composed of the elements below)
    - ☐ Proposal (15%) [Set week 6. Due week 7]
    - ☐ Update reflection (15%) [Set week 8. Due week 9]
    - ☐ Peer review of colleague's draft (15%) [Set week 9. Due week 10]
    - ☐ Video presentation (15%) [Set week 9. Due week 11. Presented week 12]
    - ☐ Final report (40%) [Due week 12]

Academic Accommodations

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes, including information about the Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances, are outlined on the Academic Accommodations website (students.carleton.ca/course-outline).

Generative Artificial Intelligence (AI) and related technologies

As a graduate course in engineering education AI tools are of interest to us from both the 'engineering' and the 'education' perspectives. So, I am proposing that AI tools will not be banned from use in this course, but I do want to allow a limited use of them to provide the maximum opportunity to engage with the material and the ideas within this course. For most of you, the theoretical aspects and some of the research methods of the course will be new and so effective consideration and engagement with the material is important.

AI use in this course

Here are some guidelines for using AI in this course. *Do not consider any of this as a requirement that you must use or explore AI tools for this course.*

1. You may use AI tools for basic word processing and formatting, such as for grammar and spell checking. However, not for text generation for use inclusion in assessed work. Put another way, you can use AI tools to improve ***your*** writing but cannot use AI tools to produce writing that you copy.
2. As this course deals with a research area with many years of published work, the limited use of AI tools for brainstorming or investigating the literature is permissible. This use must be explained in any submitted worked (see later).
3. Early on in the course we will collectively have a discussion on the use of AI tools in engineering education and in the course. Out of this we may produce further recommendations and guidelines. As the course instructor I reserve the right for final approval on such guidelines.
4. If you are thinking of using new or existing AI tools and in doubt how to appropriately use them, then do discuss with me prior to using. In short, I want to see in this graduate course appropriate learning. Assessments are to show your own learning and understanding. Passing off an AI tool's output as your own is not showing your learning.
5. When reviewing another course member's work do not upload the text (full or part) to an AI tool for assessment or analysis.

Documenting use of AI

In each submitted piece of work there needs to be towards the beginning a sub-titled and clear statement of your AI use. This is to be included even if no AI was used. Within this provide clear and succinct details of how AI was used in the work leading to the submitted piece of work. Include the name of the tool use too.

For generally citing generative AI, please see the Library's guidelines https://library.carleton.ca/guides/help/generative-ai-chatgpt-and-citations

Why have I adopted this policy?

The aim of this limited use of AI within the course is to encourage your individual engagement and consideration of the range of material in the course. As well to allow your development of your critical evaluation and analysis of ideas, as well as developing your communication skills, including you own written 'voice', without the over reliance of AI tools.

In both engineering and education we are at an interesting moment with AI and I want to use this course as a venue to appropriately, discuss and potentially explore this area, within the subject focus of this course.

As our understanding of the uses of AI and its relationship to student work and academic integrity continue to evolve, students are required to discuss their use of AI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course.