

EACJ5007: Introduction to Engineering Education Research

Term: Fall 2023

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, with particular focus (but not restricted to) the education of engineering student in universities. Areas of focus include: approaches to teaching and learning, course curricula, laboratories, educational objectives and challenges, such as equity diversity and inclusion. 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: 10:05 am - 11:25 am TR, 6th Sept. 2023 - 8th Dec. 2023

Aims

The aim of this course is to introduce 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. 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	4th Sept	Introduction to engineering education	Introduction to the course and the research area of engineering.
1	11th Sept	Taxonomies	What is a taxonomy and why use one. Types of taxonomy. Bloom, Anderson, SOLO, Fink
2	18th Sept	Learning models and learning styles	Kolb, Felder and Silverman, Schön. Learning approaches; surface, deep and strategic.
3	25th Sept	Theoretical frameworks for learning	Frameworks include: Behaviourist, Cognitivist and Situated. Understanding the perspectives in reported studies.
4	2nd Oct	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	9th 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	16th 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.
	23rd Oct	No classes. Fall break.	
7	30th 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	6th 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	13th Nov	Case Studies: Social and professional aspects of engineering education	Ethical issues; Indigenous aspects; accreditation; diversity.
10	20th Nov	Assessment	Consideration of the area of assessment.
11	27th 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	4th 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/> in case of any changes

- *4th September 2023*. Statutory holiday. University closed.
- *5th September 2023*. 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.
- *6th September 2023*. Fall term begins. Full fall, early fall and fall/winter classes begin.
- *19th September 2023*. Last day for registration and course changes (including auditing) in full fall, late fall, and fall/winter courses.
- *30th September 2023*. Last day to withdraw from full fall term and fall/winter courses with a full fee adjustment.
- *9th October 2023*. Statutory holiday. University closed.
- *23rd-27th October 2023*. Fall break, no classes.
- *15th November 2023*. Last day to withdraw from late fall term courses with a full fee adjustment.
 - 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.
- *1st December 2023*. Last day for receipt of applications from potential winter (February) graduates.
 - Last day for graduate students to submit their supervisor-approved thesis, in examinable form to the department.
- *8th December 2023*. Fall term ends.
 - Last day of 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.
- *9th December 2023*. No classes or examinations take place.
- *10th-22nd December 2023*. 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.
- *25th December 2023 through 3rd January 2024 inclusive*. University closed.

Office Hours

I will be available for office hours at **noon until 1pm on Tuesday and Wednesdays** (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.

Texts and Learning Resources

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 has 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 University is committed to providing access to the educational experience in order to promote academic accessibility for all individuals.

Academic accommodation refers to educational practices, systems and support mechanisms designed to accommodate diversity and difference. The purpose of accommodation is to enable students to perform the essential requirements of their academic programs. At no time does academic accommodation undermine or compromise the learning objectives that are established by the academic authorities of the University."

From <https://students.carleton.ca/course-outline/>

Further details on accommodations can be found at <https://students.carleton.ca/course-outline/>

COVID-19

Please refer to the last message about the remaining COVID 19 measures at Carleton, <https://newsroom.carleton.ca/2023/update-on-the-remaining-covid-19-measures/>, and follow the

recommendations, particularly stay home if unwell. If things change we will follow the new University guidelines.

Use of AI and related technologies in this course

Since the start of the last offering of this course artificial intelligence (AI) tools like ChatGPT and Google's Bard have become more widely available. In lieu of other university guidelines and recommendations I propose the following guidelines and policies regarding AI tools and large language models for this course.

First we can acknowledge that it is possible to request essay parts (or whole essays) to be written by a tool by like ChatGPT. If there is no acknowledgement and relatively little thought in using such a tool this moves quickly into the realm of academic integrity issues and what we can call here simply 'cheating'. It should also be acknowledged that AI tools will be used professionally and ethically under some circumstances. I have already had graduate students use AI imaging tools as part of their research work.

As a 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 lay out some guidelines for use. These are:

1. Use of AI tools will be acknowledge in any assessed work done for this course. This means if you use say ChatGPT, or similar, **you will have a section in your report/work (likely towards the end, similar to a references section or an acknowledgement) outlining your use of the tool.** In this you will explain how and why you used the tool and why you think it is appropriate and not cheating for academic advantage. As well, any information from an AI tool should be quoted and referenced like any other sources. Lack of such acknowledgment and the AI tool explanation section can start to move into investigations of academic integrity.
2. 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.
3. If you are thinking of using AI tools and in doubt how to appropriately use them in an assessment, 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, or someone else's work, as your own is not showing your learning.
4. Masters programs are professional level programs and you are expected to behave like professionals. I reserve the right to orally question you on written assessment work and to use that to assess you accordingly. There are presentations in this course and so I can also delve deeper into your understanding of the topic you are reporting on during those presentations (which are done in front of others).
5. Any guidelines or requirements emerging from the University, on AI use in courses, will be brought into this course and added to the discussion and requirements.
6. Do not consider any of this as a requirement that you must use or explore AI tools for this course.

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.