Topics in Cognition: Cognitive Enhancement

Department of Psychology & Neuroscience

PSYO/NESC 4130 • Winter 2025

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

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Instructor: Richard Sandy Drake, MSc
Lectures: Wednesdays, 9:35–11:25 am AST
Course delivery: in-person, LSC 5208
Prerequisites: instructor's permission

Contact details: richard.drake@dal.ca
Office hours: by appointment; in-person or virtual

Description of the Course:

The field of Cognitive Enhancement (CE) is expanding in terms of methods and evidence and has also generated much debate in terms of the best designs for studies, the underlying mechanisms, and how to measure effectiveness. This seminar course will focus on methods, mechanisms, evidence, and applications of CE derived using an array of approaches, such as video gaming, cognitive skill training, meditation, or exercise. The instructor will take the first two classes to give an overview of the field of CE, including issues of definition, research methods and standards. We will then read and critically analyze a range of topics, drawing from reviews assigned each week by the instructor, as well as other primary research material and resources. We will meet weekly to hear student presentations and to discuss themes, with an aim to draw conclusions about the current state of the evidence, as well as to identify what new research is needed for the field to advance. There will be diverse methods of evaluation, including class discussion, oral presentations, written assignments, as well as a final debate.

Learning Objectives:

At the end of the term, the engaged student will have a greater understanding of:

1. The concept of Cognitive Enhancement (CE), in terms of how it is defined and applied
2. Appropriate study designs and methods for studying CE
3. The strength of the evidence base for enhancing cognition via different approaches
4. The underlying neurocognitive mechanisms for improving cognitive function
5. Factors that may influence CE outcomes
6. Future research directions

Course Format:

We will meet weekly to review and discuss a topic reading. To encourage deep reading and self-learning enhanced by group discussion, each student will take on a specific role with regards to the reading. You will investigate the ideas in the article and incorporate them in group discussion.* There are 5 possible roles that are described below and you will have the opportunity to adopt each role in different formats at least 1–2 times throughout the course. Normally, there will be 2 students per role each week. More details on roles and formats will be discussed in the first class.

With this approach, I hope to encourage critical reading, integration, and discussion of the course readings by all students, enhanced by learning questions. Additionally, I hope that you will find adopting these different perspectives an interesting way to engage with the class material! We will end with a collaborative debate that will allow you to bring together all the course information learned throughout the term. I will provide readings and learning questions for each week, as well as occasional additional optional resources. Assessments will be based on 1) your oral presentations and ability to stimulate discussion related to your role, your participation in the discussions overall, as well as in the final class debate; 2) written assignments that include brief written summaries related to your role, as well as a short written assignment related to the final debate at the end of term. See below for more details.

Course Materials:

The emphasis will be on analysis of the primary research literature, reviews, book chapters and other resources available electronically (e.g., TED talks and other scientific video presentations). I will use Brightspace for posting the schedule, the reading list and papers, and for other activities such as submitting assignments, etc. More information on this will be provided in class. *Note that login names and passwords are case sensitive.*

I will aim to post reading material two weeks before each topic session.

Office Hours:

You can contact me to book a time to meet in person or on Microsoft Teams. I am more than happy to provide guidance and support your learning experience; I therefore encourage you to make use of office hours.

Tentative Course Schedule and Topics: Note that the schedule and topics may change depending on progress through the material, student preferences, winter storms, etc.

For general university dates, please refer to the handy reference here: https://www.dal.ca/study/plan-your-degree/important-dates.html

Week	Date	Topic(s)	Presenter(s)	Due Dates
1	Jan. 8	Meet and greet; introduction to the course and format	Instructor	**Student role schedule to be posted by January 10**
2	Jan. 15	Research methods in CE	Instructor	
3	Jan. 22	Action video gaming and perceptual plasticity	See student schedule on Brightspace for role assignments	**January 20**—last day to change and add classes for registered students; **Slides and written role summaries due by 8:00 am on the day of each session**

Week	Date	Topic(s)	Presenter(s)	Due Dates
4	Jan. 29	Cognitive training and skill learning	See student schedule for role assignments	
5	Feb. 5	Neurocognitive mechanisms of CE	See student schedule for role assignments	**February 3**—last day to drop without a "W".
6	Feb. 12	Coffee and tea	See student schedule for role assignments	
7	Feb. 19	Study break		
8	Feb. 26	Exercise	See student schedule for role assignments	
9	Mar. 5	Meditation	See student schedule for role assignments	**March 5** – last day to drop with "W"
10	Mar. 12	Clinical applications	See student schedule for role assignments	
11	Mar. 19	Ethics	See student schedule for role assignments	
12	Mar. 26	Debate prep/flex	TBD	Pros and cons list (for both sides of the debate) due **April 1, 5:00 pm AST**
13	Apr. 2	Debate		

Assessments:

Component	Weight (% of final grade)	Due Date(s)
Presenter roles (best 3/4)	15% x 3 = 45%	Slides for presentation due by **8:00 am** on day of session
Discussant roles (best 3/4)	10% x 3 = 30%	Written summary due by **8:00 am** on day of session
Debate—written summary of pros and cons	10%	**April 1 by 5:00 pm**
Debate—group work and participation on day of debate	10%	**April 2** (debate in class)
Participation	5%	

Course Requirements and Evaluation:

Presenter Roles (45%): Each student will have 4 opportunities to present and lead a discussion related to their assigned role for the weekly article. To reinforce your ideas and assist in your communication of the information, you must use and submit slides for your presentation. A description of the assigned roles is below and will be discussed in class. Evaluation of the presenter role will be based on the oral and visual components and is described below. Your final grade will be the average of the highest three grades.

Evaluation: The following provides a very general guideline for assessing the quality of your work as a Presenter. Note that this is not intended to be a comprehensive grading scheme but, instead is meant to give a "flavour" to how the grading of this assignment is influenced by the nature of the content that is provided. See the posted grading rubric for more details.

Item	Below expectations (Fair; B–/B)	Meets expectations (Good; B+/A–)	Exceeds expectations (Excellent; A/A+)
Preparation	Superficial ideas; few links to material; incomplete	Thoughtful ideas related to role; brings up relevant material to support them; reasonable coverage	Critical and deep thinking about role; thorough gathering of information with support from other material
Understanding	Concepts raised are largely anecdotal, personal	Accurately raises some key points/concepts in readings	Shows solid and critical understanding of most key points and their relevance to the field. Raises novel points.
Integration	Few connections between ideas/material discussed	Raises some connections among ideas in the reading	Raises conceptual and novel connections among ideas in current and additional material
Communication	Ideas unclear, presented in a disjointed fashion	Ideas clearly presented, mostly organized and can be understood	Ideas clear and easy to follow, well-organized, stimulates deep understanding; scholarly
Engagement (oral component only)	Material presented with little contact with audience	Makes connection with audience, seeks feedback, comments	Enthusiastic presentation, audience wholly engaged and contributing

Discussant Roles (30%): Each student will also have 4 opportunities to contribute to the discussion of a specific role as led by the presenter. A written summary is required (1–2 pages, single-spaced, reference list not included in page limit). Evaluation is based on the written component and contributions to/facilitation of the class discussion. Your final grade will be the summation of the highest three grades.

Evaluation: Your grade will be based on the quality of your arguments/summary and contributions to the discussion. This role will be graded on a 1–10 scale, based on your preparation and understanding/integration of the material and meaningful contributions to the discussion as described above.

Debate (20%): All students will participate in the debate. More information on the debate requirements and format will be provided in class.

Evaluation: Your debate grade will be based on the following oral and written criteria:
- Relevance of pros and cons list to the readings and discussions throughout the term
- Persuasiveness and coherence of arguments presented during the debate (this is a group grade)
- Quality of evidence and relation to class readings used to support arguments
- Relevance of arguments to debate topic
- Ability to provide counterarguments or challenge statements in the opposition's arguments

Participation in discussion (5%): This course is an honours seminar; as such, frequent and quality discussion is a pivotal part of the learning experience. To emphasize the importance of both general discussion and attendance, 5% of your grade will come from thoughtful contributions to the whole class discussions. A thoughtful contribution could come in many forms: a thought-provoking question, a critique of a paper, praise for something you liked about a paper, a thought about the generalizability of the results, or perhaps an interesting feature about the method. Importantly, quality contributions go beyond just saying "I agree" or "I don't understand"—you should explain the rationale for your point ("I agree, because …"). That said, I do want to emphasize that all ideas (as long as they are respectful) are welcome. Please do not feel intimidated to raise your hand. Your overall engagement with the class discussions will contribute to the 5%.

SONA bonus (up to +2%): As many of you will be collecting data for honours projects, the SONA component of this course will offer an opportunity to participate in research projects in the department. Although this course focuses primarily on cognitive enhancement, our discussions of methodology will have relatively broad applicability that may help you appreciate the designs of other experiments in which you participate.

Your overall grade will be based on the following grading scale:

Dalhousie Common Grade Scale

0–49	50–54	55–59	60–64	65–69	70–72	73–76	77–79	80–84	85–89	90–100
F	D	C-	C	C+	B-	B	B+	A-	A	A+

Course Policies:

Recordings: In-person classes may be recorded for purposes of evaluation. These recordings will be deleted once grades are assigned. If students wish to record the lectures, please notify the instructor.

Attendance/illness: Your learning will benefit from coming to every class, but please do not come to class if you are experiencing any symptoms of illness. Notify me as soon as possible if you will be missing class and alternate arrangements can be made when needed (e.g., we can hold a hybrid class for you to join by video, or an alternate assignment requirement might be appropriate).

Required readings: You are *expected* to read the assigned article each week, and you will draw upon *all* of this material in the discussions. You are *encouraged* to watch/listen/read other general resource material posted for that topic or found in your own literature searches.

Deadlines: Deadlines are posted in the schedule above. Unless prior arrangements have been made with me by noon before the day of the deadline, late submissions will receive a daily penalty of $2^{n+1}\%$, with n starting at 1 and incrementing every 24 hours at 8:01 am.[1] Please notify me as soon as possible if alternate arrangements are needed. If you are dealing with illness or a crisis and cannot make your presentation on the scheduled date, I will make all attempts possible to reschedule it before the end of the term or provide an alternative method of evaluation. If you miss the debate (which is a full-class event and therefore cannot be rescheduled), contact me to discuss alternative options for evaluating your understanding of the different sides of the issue.

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1 Submissions after 8:00 am on the due date will lose 2^{1+1} = 4%; submissions the following day will incur an 8% penalty, etc.

Collaboration and original writing: It is expected that your work on your assignments will be original work by you. You may use large language model (LLM) programs such as ChatGPT to help generate ideas and brainstorm, but you should note that the material generated by these programs may be inaccurate, incomplete, or otherwise problematic; i.e., do not trust anything it says or consider it a valid source. If it gives you a number or fact, assume it is wrong unless you either know the answer or can check it with another source. You will be responsible for any errors or omissions provided by the tool. Beware that using LLMs may also stifle your own independent thinking and creativity. Critically, if you use LLMs, you need to acknowledge using it as you would any other source. Please include a paragraph at the end of any written assignment in the reference list (this will not count in the page limits) for which you used LLM(s) explaining what you used the LLM(s) for and what prompts you used to get the results. Transcripts of prompts and responses with LLMs will also not count against the word limit (within reason), though you should be judicious in only showing what is relevant. Failure to properly attribute use of LLMs is in violation of Dalhousie's academic integrity policies. I also may perform plagiarism checks using any of the methods described on this web page: https://www.dal.ca/dept/university_secretariat/academic-integrity/faculty-resources/detecting.html

Etiquette: I aim for our discussions to be a safe, interesting, and engaging way to further your learning and application of the material. As such, it is expected that online and in-person communications will be professional, respectful, and considerate of others. It is important to respect the diversity of backgrounds of your peers and others in the field, noting that their opinions may differ from yours. If you disagree with a statement, do so respectfully and acknowledge the valid points in your classmates' argument. Focus on the ideas and not the person; be empathic.

Reading and Discussion Roles Descriptions

More on these roles will be elaborated in class. Below is a brief summary.

Discussion Leader. Your job is to help facilitate the discussion and to make sure that the class arrives at answers to the learning questions posted with the article by the end of the class discussion. You will start the session by reviewing the questions and end the session by discussing the answers with the class. Your facilitation should draw on the critical passages in the article that summarize and encapsulate the main points. Rephrasing and explaining information in lay terms is another important tool of the discussion leader that will demonstrate understanding of the material. Your submission (presentation or discussant written assignment) will include your own brief answers to the questions.

Historian (Time Traveller #1). Your job is to find out where the assigned paper sits in the context of previous work in the field. How was it shaped by the zeitgeist/ideas of the time? Find and briefly report on one earlier paper cited within the current article that had an important influence on the authors' thinking. You should emphasize the connections between your chosen article and the reading. Help us understand the justification and rationale for the research on a deeper level by communicating how others had formulated or worked on similar problems. How novel are the ideas communicated in the assigned reading? In the course of writing their paper, did they omit anything important that you would have liked to see addressed? You will indicate in your submission (presentation or discussant written assignment) why you chose your paper and reflect on what you discovered.

Futurist (Time Traveller #2). Your job is to find out where the assigned paper sits in the context of future work in the field. How did it shape the views or goals of those who came after? Find and briefly report on one newer article that was inspired by and cites the current article. You should emphasize the connections between your chosen article and the reading. Consider whether the attitudes expressed in your chosen article's introduction are reasonable in light of the strength of the data and conclusions described in the assigned reading. Did the conducted future work match the expectations reported in the assigned reading? You will indicate in your submission (presentation or discussant written assignment) why you chose your paper and reflect on what you discovered.

Peer Reviewer: Your job is to appraise the ideas in the article. Play the role of the contrarian by developing questions or arguments that might be raised by critics of the authors, or that suggest a different point of view. Conversely, indicate where and why the authors made a good argument or decision in light of what you have been learning about the field of cognitive enhancement. Your arguments will of course depend on the paper, but I encourage you to bring together as much of what you have learned in the course as possible. This is an excellent opportunity to practice scholarship by offering strong arguments grounded in the assigned material. You will present or submit (depending on role) at least two arguments (minimum one critique and one point of praise), including a statement and rationale for why you are making these points.

Application Specialist: Your job is to focus on the application of the information and evidence described in the article. You could play the role of the entrepreneur and create and present/submit a convincing "pitch" for a product, or you could instead wear the shoes of a policymaker advocating for change in educational, healthcare, or legal settings. Your arguments should be grounded in the evidence. Think about the potential for both positive and negative impacts of applications to the material. I encourage you to be creative with how you present your proposal. Although you can certainly stick to academic slides and text, you may consider alternative forms of presenting and/or submitting your work for this particular role (e.g., infographics, designs, letters to public officials, etc.). Submissions (presentations or discussant written assignment) will address your proposal, making clear reference to the assigned reading/topic.

*I want to thank Dr. Gail Eskes, Dr. Erin Sparks, and the authors of two articles who have proposed and endorsed this method of class discussion:

Parrott, H. M., & Cherry, E. (2011). Using structured reading groups to facilitate deep learning. *Teaching Sociology*, *39*(4), 354-370. https://doi.org/10.1177/0092055X11418687

Jacobson, A. and Raffel, C. (2021, March 17). *Role-playing paper-reading seminars*. Colin Raffel Blog. https://colinraffel.com/blog/role-playing-seminar.html.

Section B
University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: https://www.dal.ca/about-dal/internationalization.html

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: http://www.dal.ca/cultureofrespect.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. The full Code of Student Conduct can be found at:
https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at:
https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at: https://www.dal.ca/about/leadership-governance/academic-integrity/faculty-resources/ouriginal-plagiarism-detection.html

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.

Faculty of Science
Student Resources and Support

University Policies and Programs

Important Dates in the Academic Year (including add/drop dates):
http://www.dal.ca/academics/important_dates.html

Classroom Recording Protocol: https://www.dal.ca/dept/university_secretariat/policies/academic/classroom-recording-protocol.html

Dalhousie Grading Practices Policies:
https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Grade Appeal Process: https://www.dal.ca/campus_life/academic-support/grades-and-student-records/appealing-a-grade.html

Sexualized Violence Policy: https://www.dal.ca/dept/university_secretariat/policies/health-and-safety/sexualized-violence-policy.html

Scent-Free Program: https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html

Learning and Support Resources

General Academic Support – Advising (Halifax):
https://www.dal.ca/campus_life/academic-support/advising.html

General Academic Support – Advising (Truro):
https://www.dal.ca/about-dal/agricultural-campus/ssc/academic-support/advising.html

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html

On Track (helps you transition into university, and supports you through your first year at Dalhousie and beyond): https://www.dal.ca/campus_life/academic-support/On-track.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Indigenous Connection: https://www.dal.ca/about-dal/indigenous-connection.html

Elders-in-Residence (The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit the office in the Indigenous Student Centre or contact the program at elders@dal.ca or 902-494-6803: https://cdn.dal.ca/content/dam/dalhousie/pdf/academics/UG/indigenous-studies/Elder-Protocol-July2018.pdf

Black Student Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre.html

LGBTQ2SIA+ Collaborative: https://www.dal.ca/dept/vpei/edia/education/community-specific-spaces/LGBTQ2SIA-collaborative.html

Dalhousie Libraries: http://libraries.dal.ca/

Copyright Office: https://libraries.dal.ca/services/copyright-office.html

Dalhousie Student Advocacy Services: https://www.dsu.ca/dsas?rq=student%20advocacy

Dalhousie Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Human Rights and Equity Services: https://www.dal.ca/dept/hres.html

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Study Skills/Tutoring: http://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Faculty of Science Advising Support: https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html

Safety

Biosafety: http://www.dal.ca/dept/safety/programs-services/biosafety.html

Chemical Safety: https://www.dal.ca/dept/safety/programs-services/chemical-safety.html

Radiation Safety: http://www.dal.ca/dept/safety/programs-services/radiation-safety.html

Laser Safety: https://www.dal.ca/dept/safety/programs-services/radiation-safety/laser-safety.html