

INTEG 220

The Nature of Scientific Knowledge

T, TH 1:00 – 2:20 PM; EV2-2069 (KI Studio)

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(Note: You MUST include '220' in the subject line of emails to me if you would like a timely response!)

Course Description

Epistemology is the branch of philosophy that examines the nature of knowledge. While most epistemology courses focus on ordinary, everyday knowledge, this course (and the one that follows) will examine the nature of disciplinary knowledge. INTEG 220 will focus on epistemological questions about the natural and physical sciences while INTEG 221 will emphasize the humanities and social sciences (and, in particular, the social nature of knowledge), although there will be significant overlap between the courses.

During INTEG 220, we will engage in multiple cycles of (1) *reading* and *discussing* philosophical theories of scientific knowledge; (2) *listening* to and *engaging with* a scientific expert about the nature of knowledge in his or her discipline; and (3) *reflecting* on the nature of knowledge in various disciplines through discussion and writing. Topics will include: scientific reasoning, progress in science, forms of scientific evidence, and epistemic pluralism (different ways of knowing). While we will discuss these issues with respect to science in general, we will emphasize their relation to the disciplines represented by our guest speakers. During the last part of the course, we will read about and reflect on the nature of disciplinarity, interdisciplinary interactions, and how the topics of this course relate to the goals of Knowledge Integration. Afterwards, you will have the opportunity to work in small groups to synthesize what you have learned by comparing the nature of knowledge across disciplines.

Course Objectives

By the end of this course you should be able to do the following:

Knowledge/ comprehension:	<ul style="list-style-type: none"> • Identify epistemological issues in science • Describe philosophical views of the nature of scientific knowledge
Application / analysis:	<ul style="list-style-type: none"> • Thoughtfully apply an epistemological issue to a scientific discipline • Compare/ contrast the nature of knowledge in different disciplines
Evaluation/ creation:	<ul style="list-style-type: none"> • Critically evaluate an epistemological issue through reflective writing and in-class or online discussion
Transferable skills:	<ul style="list-style-type: none"> • Improve your ability to read and comprehend difficult material • Practice and improve your analytical writing skills • Assess the work of your peers in a constructively critical way

Expectations for this Course

This course is intended to be reading-, writing-, and participation-intensive.

<p>We are all expected to:</p> <ul style="list-style-type: none"> Attend every class & be on time Be prepared for lecture & engage in class discussions and activities Listen attentively when others speak 		<p><i>Note: For a timely response, please include '220' in the subject line of any emails you send me.</i></p>
<p>You are also expected to:</p> <ul style="list-style-type: none"> Anonymize assignments and submit them on time, using the appropriate drop-box on LEARN Read and carefully consider instructor feedback on written and oral work Use scheduled office hours for consultation (or make an appointment); use email for less substantive questions 	<p>You can also expect me to:</p> <ul style="list-style-type: none"> Provide instructions for each assignment at least 10 days in advance and allow time for students' questions in class Provide timely and helpful feedback on participation and course assignments Be available during office hours and via email; respond to emails by the end of the next business day 	

Required Reading Material and Submitting Assignments: LEARN

There are no required textbooks for this course; instead, all readings will be posted on LEARN. Please download, print, and bring the readings with you to class. *Note that changes may be made to the schedule of topics or readings; any changes will be announced in class and on LEARN.*

Grading/Evaluation

All graded work will be evaluated out of 100 points in 5-point increments (e.g. 75, 80, or 85), though "in-between" grades (e.g. 75/80, or 77.5) may be assigned if necessary. Each assignment carries a different weight in your course grade. Note that there are two possible grading schemas, depending on whether you choose to write Short Essay #3 (which is optional). Should you write SE#3, option 1 will only be applied if doing so will increase your final grade in the course. *Note: there is no final exam for this course.*

Participation/Engagement	Option 1	Option 2	
<ul style="list-style-type: none"> Attendance, in-class discussion, LEARN discussion, in-class activities 	15%	15%	Throughout the course
Short Essay Assignments & Peer Review			
<ul style="list-style-type: none"> Short essay #1 	15%	10%	Due Friday, October 7
<ul style="list-style-type: none"> Short essay #2 	20%	15%	Due Monday, October 31
<ul style="list-style-type: none"> Peer reviews 	10%	10%	Due Wednesday, November 9
<ul style="list-style-type: none"> Short essay #3 (OPTIONAL) 	0%	15%	Due Monday, November 28
Compare & Contrast			
<ul style="list-style-type: none"> In-class group presentation 	10%	10%	Due Thursday, November 24
Final Paper			
<ul style="list-style-type: none"> Topic & outline 	--		Due Thursday, December 1
<ul style="list-style-type: none"> Final Paper 	30%	25%	Due Monday, December 12

Guest Lecturers

The guest lecturer visits are an integral part of this course. Most guest speakers will come for two visits: during the first visit, he or she will talk about the nature of knowledge in their discipline and discuss some of their own research, while the second visit will take some form of a Q&A session. It is important that everyone arrive on time and well prepared for class – not only will you be reflecting on these visits in your course work, but it's also important that we respect the value of the time the guest are sharing with us.

Participation/Engagement

Participation/engagement is an important part of this course and is based on the following components:

- **Attendance:** A sign-in sheet will be passed around during each class; you are responsible for marking yourself present and “on time”. If you know in advance that you won't be able to attend class, please send me an email. You will be allowed **two unexcused absences**; additional unexcused absences will each result in a 5% decrease in your participation grade. Failing to regularly come to class on time will also decrease your participation grade, while bonus participation marks will be given for perfect attendance.
- **Class discussion:** A significant portion of your engagement grade will be based on thoughtful, relevant, and respectful contributions to class discussions. There will be several avenues of discussion in this course, each of which are part of your course engagement:
 - *Whole-class discussion:* There will be a focus on in-class discussion in this course and everyone is encouraged to contribute often. If you are uncomfortable speaking in front of the whole class, you may do more of your participating online.
 - *Online discussion:* You will have the opportunity to contribute to online discussions via the discussion board on LEARN. Everyone will be expected to make at least one post by the start of class on September 22nd; however, those who are uncomfortable contributing to whole-class discussions are encouraged to post to the discussion board more frequently.
 - *Small group discussion:* You will be working in small groups throughout the term. Everyone is expected to be prepared to thoughtfully discuss the assigned readings in small group discussion. At the end of the course, you will be asked to evaluate your fellow group members on how well they have engaged during small group activities (evaluations are due Monday, December 5th). Frequently coming to class without doing the readings and/or failing to fully participate in small group discussions will lower your engagement grade.
- **In-class assignments/ activities:** Throughout the semester, there may be a few small activities or assignments (e.g., evaluating your group members). These will be assessed on a check/check-plus/check-minus basis, and will go towards your participation grade, unless otherwise noted.
- **Additional participation options:** If you are reluctant to participate in class discussion, you may contribute in other ways, such as helping to plan the Q&A portion of a guest lecture visit (e.g., by designing the format of the Q&A session) or taking course notes on a shared Google Doc.

Participation/engagement grades will be determined at the end of the course, but I will provide mid-term evaluations upon request to give you an idea as to how you're doing.

Short Essay Assignments & Peer Reviews

After each of the first guest lecturer visits, you will submit a short essay in which you will analyze an appropriate epistemological issue of your choosing and discuss how you think it relates to the nature of knowledge in the guest lecturer's discipline. After completing short essay #2, you will also be asked to review and evaluate the work of your peers (this is a great opportunity to read other students' work!).

Below are brief descriptions of each of the short-essay assignments (detailed instructions will be provided at least ten days in advance of the due date). Unless noted otherwise, written assignments are **due by 6:00pm** on the due date and must be submitted in the appropriate drop-box on LEARN. Before submitting an assignment, you must appropriately anonymize your paper as explained in the assignment instructions.

- **Short essay #1:** In the first assignment, you will write a short essay (up to 800 words long), following the assignment instructions provided on LEARN. The focus will be on formulating a thesis statement and a draft of your argument, thus emphasizing content over style. This assignment will be an opportunity to gain instructor feedback on your approach to analysing and synthesizing key ideas from the course, as well as on the content of your argument, before you go on to write a longer essay.
- **Short essay #2:** In the second assignment, you will complete a short essay (up to 1000 words), again following the assignment instructions. This assignment will be an opportunity to gain feedback about both your thesis/argument and your writing style; in addition, you will be receiving feedback from two of your peers (see below).
- **Peer reviews:** Once short essay #2 has been submitted, each student will receive TWO essays written by other students to read and assess. Each review should be about 500 words, and will be shared with their author. (Note: the process will be anonymized so you will not know whose paper you're reviewing nor who has reviewed your paper.) You will receive feedback on the peer reviews that you write, and will also be able to see instructor feedback on the reviews of your paper.
- **Short essay #3 (OPTIONAL):** After the last guest lecture, you will have the option to write a third short essay (up to 1000 words). If you do not submit this assignment, you will not be penalized. If you do submit it, your mark will be included in your final grade only if it would increase the final grade you receive in this course. Also, if you submit a paper, you will receive instructor feedback about your thesis, argument, and writing style in preparation for your final paper.

Compare/ Contrast Presentation

After all the guest lecturers have visited, you will have an opportunity to work in a small group to reflect on the similarities and differences regarding the nature of knowledge in the three disciplines represented. Your group will receive one grade on this assignment, which will be based a short in-class presentation as well as a visual (e.g., PowerPoint, Prezi, or handout) that you should prepare and submit in advance of the presentation. Specific instructions will be provided on LEARN, and guidelines for acceptable group work practices will be discussed.

Final Paper

In place of a final exam, you will write a final paper of 2000-2500 words (roughly 8-10 pages double-spaced), on a topic of your choosing. The final paper is a chance to demonstrate that you can integrate the skills acquired and/or improved through previous assignments, as well as an opportunity to explore a topic in more depth that interests you. Your topic must significantly draw on course material (readings, lectures, or discussions), though it can go beyond what we've covered in class. It can, but does not need to, reference any of the material from the guest lecturers, and does not require any additional research.

- *Outline (+/-)*: You must hand in a description of your topic and a one-page outline for your paper **by 6pm on Thursday, December 1st**. That day, you will have the opportunity to discuss your topic with your small group, and to make changes or additions to your outline before you submit it. You will receive feedback in the form of either (a) approval to proceed with your topic, with some general comments about the topic and/or your outline, or (b) a request to discuss your topic with the instructor during office hours. Failure to hand in a sufficient description/outline will result in a 5-point penalty on the grade for your final paper.
- *Final paper (25%)*: The final paper is due **on Monday, December 12th at 6:00pm**, and must be appropriately anonymized and submitted on LEARN. Detailed instructions will be discussed in class and provided online well in advance of the due date.

Late Policy

Assignments are **due by 6:00pm** on the date specified in the appropriate dropbox on LEARN, unless otherwise noted. There will be a **2.5-point penalty** for each day or part of a day that the paper is late, including weekends. Please note an exception to this: due to the need to distribute copies of Short Essay #2 (due Monday, October 31st) for the peer review assignment, **Short Essay #2 will not be accepted after Wednesday, November 2nd at 6pm**. NOTE: if you do not speak English fluently, you may request a two-day extension for your written assignments (without penalty), provided you visit the UW writing centre.

Claiming Assignments

Assignments will be returned via LEARN (or PEAR, if we end up using that system). No paper copies will be retained, though electronic copies with instructor feedback will be retained unless a student requests (via email) that they not be, in which case they will be deleted within one term following the end of the course.

NOTE: Mental health issues & Counseling Services

Mental health is a serious issue for everyone and can affect your ability to do your best work. Counselling Services (www.uwaterloo.ca/counselling-services) is an inclusive, non-judgemental, and confidential space for anyone to seek support. They offer the following services:

- Confidential counselling for a variety of areas including anxiety, stress management, depression, grief, substance use, sexuality, relationship issues, and much more.
- Workshops held throughout term to assist you with areas like stress management, managing your mood, procrastination, mindfulness, depression, coping skills, etc.
- Assistance with academic accommodations due to a mental health issue (Counselling Services can help set you up with the AccessAbility Office).

University Policies

<p>◆ Accommodations for students with disabilities: The AccessAbility Services Office, located in the Needles Hall extension (room 1401), collaborates with all academic departments to arrange appropriate accommodations for students with <u>permanent and/or temporary</u> disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the Accessibility Services at the beginning of each academic term. www.uwaterloo.ca/disability-services</p> <ul style="list-style-type: none"> ○ NOTE from the course instructor: <i>The AccessAbility Services Office can offer support for a variety of disabilities such as ADHD, chronic pain, etc. If you think you might benefit from accommodations, I strongly encourage you to speak with someone in Accessibility Services as soon as possible. Even if they cannot offer you academic accommodations, Accessibility Services advisors can help connect you with other support resources on campus.</i>
<p>◆ Religious Observances: Please inform the instructor at the beginning of term if special accommodation needs to be made for religious observances that are not otherwise accounted for in the scheduling of classes and assignments.</p>
<p>◆ Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. For more information, see www.uwaterloo.ca/academicintegrity/</p> <p>◆ Students who are unsure what constitutes an academic offence are requested to visit the on-line tutorial at http://www.lib.uwaterloo.ca/ait/</p>
<p>◆ Discipline: A student is expected to know what constitutes academic integrity, to avoid committing academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, www.adm.uwaterloo.ca/infosec/Policies/policy71.htm.</p> <p>For typical penalties, check Guidelines for Assessment of Penalties, www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm</p> <ul style="list-style-type: none"> ○ <i>Within ENV, those committing academic offences (e.g. cheating, plagiarism) will be placed on disciplinary probation and will be subject to penalties, which may include a grade of 0 on affected course elements, 0 on the course, suspension, and expulsion.</i>
<p>◆ Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 – Student Petitions and Grievances, Section 4, www.adm.uwaterloo.ca/infosec/Policies/policy70.htm. When in doubt please contact your Undergraduate Advisor who will provide further assistance.</p>
<p>◆ Appeals: A decision made or penalty imposed under Policy 70 - Student Petitions and Grievances (other than a petition) or Policy 71 – (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals); see: www.adm.uwaterloo.ca/infosec/Policies/policy72.htm</p>

Course Schedule: Topics, Readings, and Assignments

Day	Date	Topics/ Activities	Readings	Assignments (Due)
Thurs	Sept 8	Course overview		
Tues	Sept 13	What is science?	Chalmers, Intro & Ch. 1	
Thurs	Sept 15	Scientific reasoning	Chalmers, Ch. 4	
Tues	Sept 20	Inference to the best explanation	Johns	
Thurs	Sept 22	Ignorance in science	Firestein	LEARN post due
Tues	Sept 27	Guest Lecturer: James Danckert	Marshall & Halligan	
Thurs	Sept 29	Guest Lecturer: James Danckert	Johnson	
Tues	Oct 4	Knowledge in Psych & Writing	--	
Thurs	Oct 6	Falsificationism	Chalmers, Ch. 5 & 6	Short essay #1 due (Friday, Oct 7)
Tues	Oct 11	<i>(NO CLASS: Thanksgiving Break)</i>		
Thurs	Oct 13	Holism	Chalmers, Ch. 7	
Tues	Oct 18	Scientific progress	Chalmers, Ch. 8	
Thurs	Oct 20	Guest lecturer: TBD	Dirac (or TBD)	
Tues	Oct 25	Guest lecturer: TBD	Firestein	
Thurs	Oct 27	Knowledge in Physics & Writing	--	
Tues	Nov 1	Epistemological pluralism	Miller et al.	Short essay #2 due (Monday, Oct 31)
Thurs	Nov 3	What is a discipline?	Krishnan	
Tues	Nov 8	Evidence: lab vs. field work	Scheiner	
Thurs	Nov 10	Guest lecturer: Rebecca Rooney	Rooney et al., Levins	Peer reviews due (Wednesday, Nov 9)
Tues	Nov 15	Knowledge in Biology & C/C prep	--	
Thurs	Nov 17	Collaboration across disciplines	Eigenbrode et al.	
Tues	Nov 22	(Inter)disciplinary expertise	Collins & Evans	
Thurs	Nov 24	Compare & contrast disciplines	--	Group presentations
Tues	Nov 29	Course synthesis & writing prep		Short essay #3 (opt.) (Monday, Nov 28)
Thurs	Dec 1	Course wrap-up	--	Final paper topic due

List of Readings

- Chalmers, Alan F. (1999). *What is This Thing Called Science* (3rd ed.). Indianapolis, IN: Hackett Publishing Company, Inc. (Introduction, chapter 1, chapters 4-8.)
- Collins, Harry, and Robert Evans (2007). *Rethinking Expertise*. Chicago: The University of Chicago Press. (Chapter 1.)
- Dirac, Paul (1939), "The Relation Between Mathematics and Physics", *Lecture*.
- Eigenbrode, Sanford, et al. (2007), "Employing Philosophical Dialogue in Collaborative Science." *Bioscience*, 57(1): 55-64.
- Firestein, Stuart (2012), *Ignorance: How it Drives Science*. New York: Oxford University Press.
- Johnson, Eric Michael (2011), "The WEIRD Evolution of Human Psychology," *Scientific American*, <http://blogs.scientificamerican.com/primate-diaries/2011/12/07/the-weird-evolution-of-human-psychology/>
- Krishnan, Armin (2009), "What are Academic Disciplines? Some Observations on the Disciplinarity vs. Interdisciplinarity Debate." *ESRC National Centre for Research Methods, NCRM Working Paper Series*.
- Levin, Simon A. (2010), "The Evolution of Ecology." *The Chronicle of Higher Education*, <http://chronicle.com/article/The-Evolution-of-Ecology/123762/>
- Lipton, Peter (2000), "Inference to the Best Explanation." In W.H Newton-Smith (Ed.), *A Companion to Philosophy of Science* (pp. 184-193).
- Marshall, John C. & Peter W. Halligan (1988), "Blindsight and insight in visuo-spatial neglect." *Letters to Nature*, vol. 336, pp. 766-767.
- Miller, Thaddeus R., et al. (2008), "Epistemological Pluralism", *Ecology & Society*, 13(2): 46.
- Rooney, Rebecca, Suzanne E. Bayley, and David W. Schindler (2011), "Oil Sands Mining and Reclamation Cause Massive Loss of Peatland and Stored Carbon." *PNAS*, 109(13): 4933-4937.
- Scheiner, Samuel M. (2004). "Experiments, Observations, and Other Kinds of Evidence." In Mark L. Taper and Subhash R. Lele (Eds.), *The Nature of Scientific Evidence: Statistical, Philosophical, and Empirical Considerations* (pp. 51-66). Chicago: The University of Chicago Press