Principles of Scientific Reasoning

HPS 0611

Instructor: Shahin Kaveh   Email: skaveh@pitt.edu

Office: C 1126B, T-Th 2:45-3:45pm   Phone: 412-624-7599

Class schedule: T-Th 4-5:15   Class location: C 337

Course Description:

The course will provide students with elementary logic skills and an understanding of scientific arguments to apply in all aspects of their academic as well as daily lives. Our society and the world around us are increasingly influenced by scientific findings. From medicine to technology to government policy, scientific reasoning plays a prominent role both in understanding the problems faced by human beings and in finding solutions to them. Scientific reasoning is often crucial to understanding what causes the issue and what interventions are effective. We hear, for example, that drinking alcoholic beverages in moderation reduces the chances of heart disease. We might well ask what sorts of tests were done to reach this conclusion and do the tests really justify the claim. What should we make of such claims? We hear disputes about poverty and inequality, but we rarely hear evidence-based arguments regarding what causes these issues and what solutions are effective. Can science help us find solutions to these problems? In this course we will learn how these questions can be addressed systematically through scientific reasoning and decided by empirical evidence.

Each week we will learn about a new topic in scientific reasoning. We will then apply what we learned to an issue of interest to contemporary society, and ask how these questions can be answered scientifically.

Note: This course will address potentially sensitive issues.

Grades will be uploaded to: http://courseweb.pitt.edu

Recommended Texts

Salmon, M. H. (2012), *Introduction to Logic and Critical Thinking*, Wadsworth Publishing

Ladyman, J. (2001), *Understanding Philosophy of Science*, Routledge

Norton, J. D. (1998), *How Science Works*, McGraw-Hill

Gensler, H. J. (2010), *Introduction to Logic*, 3rd edition, Routledge

Gimbel, S. (2011), *Exploring the Scientific Method*, University of Chicago Press

The Structure of the Class:

Tuesdays:

4-4:30: Guided discussion of reading material

4:30-5:15: Homework discussion and practice

Thursdays:

Completed HW assignment due

4-4:55: Discussion of homework

4:55-5:15: Weekly short test

Assignments and Grades:

1- Weekly homework: A homework assignment is due in class at the beginning of every Thursday session. You will have 13 homework assignments. **Three of your worst homework assignments will be dropped. The remaining ten will comprise 30% of your final class grade.**

2- Weekly short tests: There will be a short in-class test at the end of every Thursday session. These tests are based on the reading and very similar to the homework. Doing the reading and understanding the homework will therefore be extremely helpful for the tests. **Three of your worst short tests will be dropped. The remaining ten will comprise 70% of your final class grade.**

3- Extra credit: ONE extra credit assignment is available and **will be worth 2% of your final class grade**. This assignment is due on Dec. 10th.

4- Attendance is technically not mandatory, but by attending you will:

   o find the readings far more accessible and thus have much better grades on the homework assignments and tests;

   o get practice for the homework due on Thursday;

   o familiarize me with your abilities, thoughts, and personal style of talking which gets reflected in your writing, which in turn helps me understand your answers better and give you better grades.

Ground rules of class discussion:

Throughout the semester, we will be addressing many complex, controversial, and/or sensitive questions and concepts. In order to have a fun and productive discussion, we will adhere to a strict policy of <u>separating the individual from the idea</u>.

(1) This class is a <u>safe space</u> for all individuals. All individuals regardless of their ideas, lifestyle, or background are accepted and safe in class, provided they too adhere to the rules listed here.

(2) This class is an <u>open space</u> for ideas. All ideas, no matter how uncommon, controversial, or seemingly unvirtuous are welcome and accepted for open debate.

(3) This class is a <u>critical space</u> for ideas. No idea no matter how common, uncontroversial, or seemingly virtuous is immune from scrutiny and criticism.

<u>You will NOT be graded on your opinions as long as you can defend them with reasons. Remember that reasonable minds can differ on any number of perspectives, opinions, and conclusions.</u>

Other Matters:

Math and logic tutoring:

Pitt's Learning Skills Center provides tutoring for students struggling with math and logic. If you think that you might need help, contact specialist Donna Beard at 412-648-7920 or visit the Learning Skills Center at 311 Pitt Union.

Students with Disabilities:

Disability Resources and Services (DRS) is the designated department by the University to determine reasonable accommodations and services. At the University of Pittsburgh, we are committed to providing equal opportunities in higher education to academically qualified students with disabilities. If you need assistance, contact the Office Of Disability Resources Services at 412-648-7890 or visit them at 140 Pitt Union.

Academic Integrity:

Cheating/plagiarism will not be tolerated. Students suspected of violating the University of Pittsburgh Policy on Academic Integrity, from the February 1974 Senate Committee on Tenure and Academic Freedom reported to the Senate Council, will be required to participate in the outlined procedural process as initiated by the instructor. A minimum sanction of a zero score for the quiz or exam will be imposed.

View the complete policy at www.cfo.pitt.edu/policies/policy/02/02-03-02.html

Course Schedule:

8/27: Intro; Where did the explosion of wealth come from?

No reading assignment

8/29: Do horoscopes work?!

No homework assignment; no test

9/3: Case study: Is intelligence hereditary?

Reading 1.: Norton's *How Science Works*, Chapter 1

9/5: Discussion: Is intelligence hereditary?

HW 1 due; Test 1 in class

9/10: The Basics I: What are statements?

Reading 2.: Gensler's *Introduction to Logic*, Chapter 3

9/12: Discussion: Identifying statements

HW 2 due; Test 2 in class

9/17: The Basics II: What are arguments?

Reading 3.1.: Salmon's *Introduction to Logic and Critical Thinking*, Chapter 1

9/19: Discussion: Identifying arguments

Reading 3.2.: Salmon's *Introduction to Logic and Critical Thinking*, Chapter 2

HW 3 due; Test 3 in class

9/24: Practicing deduction and induction

Reading 4.: Salmon's *Introduction to Logic and Critical Thinking*, Chapter 3

9/26: Discussion: Deduction and induction

HW 4 due; Test 4 in class

10/1: Theory vs. observation

Reading 5.1.: Ladyman's *Understanding Philosophy of Science*, Chapter 2

Reading 5.2.: Ladyman's *Understanding Philosophy of Science*, pp. 109-115

10/3: Discussion: Theory and observation

Reading 5.3.: Gimbel's *Exploring the Scientific Method*, pp. 46-52 (Francis Bacon)

HW 5 due; Test 5 in class

10/8: Controlled trials

Reading 6.1.: Salmon's *Introduction to Logic and Critical Thinking*, Chapter 5, pp. 167-194 only

10/10: Discussion: Controlled trials

Reading 6.2.: Norton's *How Science Works*, Chapter 3

HW 6 due; Test 6 in class

10/15: Probability and statistical methods

Reading 7.1.: Norton's *How Science Works*, Chapter 9

10/17: Discussion: Probability and statistical methods

Reading 7.2.: Norton's *How Science Works*, Chapter 10, pp. 1-17

HW 7 due; Test 7 in class

10/22: Hypothesis testing

Reading 7.2.: Norton's *How Science Works*, Chapter 10, pp. 17-27

Reading 8.: Norton's *How Science Works*, Chapter 11

10/24: Discussion: Hypothesis testing

HW 8 due; Test 8 in class

10/29: Inference to the Best Explanation

Reading 9.1.: Kaveh's *Logic: A Colorful Approach*, Chapter 2

10/31: Discussion: Inference to the Best Explanation

Reading 9.2.: Ladyman's *Understanding Philosophy of Science*, Chapter 7

HW 9 due; Test 9 in class

11/5: Confirmation and disconfirmation

Reading 10.1.: Salmon's *Introduction to Logic and Critical Thinking*, Chapter 7

11/7: Discussion: Confirmation and disconfirmation

Reading 10.2.: Ladyman's *Understanding Philosophy of Science*, Chapter 3

HW 10 due; Test 10 in class

11/12: Confirmation bias and spurious patterns

Reading 11.: Norton's *How Science Works*, Chapter 2

11/14: Discussion: Confirmation bias and spurious patterns

HW 11 due; Test 11 in class

11/19: The Problem of Scientific Realism I

Reading 12.1.: Ladyman's *Understanding Philosophy of Science*, Chapter 5

11/21: Discussion: Realism I

Reading 12.2.: Gimbel's *Exploring the Scientific Method*, pp. 182-197 (Thomas Kuhn)

HW 12 due; Test 12 in class

11/26, 11/28: THANKSGIVING BREAK; NO CLASS!

12/3: The Problem of Scientific Realism II

Reading 13.1.: Ladyman's *Understanding Philosophy of Science*, Chapter 6

12/5: Discussion: Realism II

Reading 13.2.: Gimbel's *Exploring the Scientific Method*, pp. 307-314 (Bruno Latour)

HW 13 due; Test 13 in class