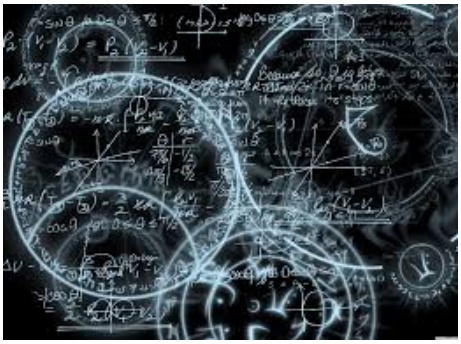
PHIL – 2314
Perspectives on Science & Mathematics
Fall 2017



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Office Hours: Tues & Thurs 11 am – 12 noon.

Time and Place of Class Meetings: Tuesdays & Thursdays, 12:00 – 1:50, Life Sciences, Room 101.

Blackboard class website: www.elearn.uta.edu

Description of Course Content: In this course we cover topics and episodes in the history of science and mathematics from an historical and philosophical point of view. The overall aim is to give students a sense of the history and context of the development of the very idea of the study of nature; that is, of the very concept of 'science'. We examine this development in the evolution of the concepts, methods, and worldviews underpinning the rise of science and mathematics through the ages, and their social and cultural contexts.

The course is divided into four broad topics: Science and Math in Antiquity; Logic and the Foundations of Mathematics; the Epistemology and Methodology of Science; and lastly, Darwin and the Theory of Evolution. As we examine each topic, thinker and theory, we will do so with the social and cultural context in view.

Student Learning Outcomes

General: The successful student will acquire the ability to skillfully incorporate material from the history, philosophy, and sociology of science into the teaching of science and math. The student will acquire a nuanced understanding of the social and cultural forces that have shaped the history of these disciplines, and continue to affect the appropriation of the sciences today. This understanding of the broader historical and philosophical background and context of science and math will provide the future teacher with added dimensions of richness with which to teach and inspire their future students.

Specific: Students who attend classes, complete readings and attend to in-class discussions:

Student will…	*Evidence/Assessment*
describe the historical and philosophical development of aspects of science and mathematics relevant to future teachers	Discussion Posts 5E Lesson Plans
describe several analytic frameworks for understanding the history and philosophy of science and mathematics;	Research Paper Final Exam
analyze the history and content of evolutionary theory	Discussion Posts Final Exam
express ideas and opinions clearly and effectively in formal written and oral communication	Research Paper 5E Lesson Plans Lesson Plan Presentations
develop high quality research skills including a) searching for relevant materials, b) evaluating the provenance and reliability of resources, c) identifying resources specific to and available for teachers and d) finessing citation and bibliographic skills	Research Paper 5E Lesson Plans
integrate approaches and materials learned in the course with independent research and science or math content to design middle and high school science and math lessons	Creation and revision of 5E Lesson Plans Peer-review of 5ELesson Plans
work effectively in a collaborative environment; provide and accept useful peer review of work	5E Lesson Plans Peer reviews of Research Papers and Lesson Plans.

Core curriculum objectives:
Critical Thinking Skills: to include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information;
Communication Skills: to include effective development, interpretation and expression of ideas through written, oral and visual communication;
Social Responsibility: to include intercultural competence, knowledge of civic responsibility, and the ability to engage effectively in regional, national and global communities; and
Personal Responsibility: to include the ability to connect choices, actions and consequences to ethical decision-making.

Course Structure and what is expected of students:
We will be using BLACKBOARD for this course, available here: https://elearn.uta.edu/

- Please be sure to log in and find this course asap. Here, you will find folders set up for each class of the course – Classes 1 though 30. In each folder you will find the ***required*** readings and supplementary materials on the topic**. The reading and materials in each folder must be read *in advance of that* class**. You will also find a mid-term Research Paper Folder and a Lesson Plan Folder. Inside of these you will find instructions for the relevant assessment, and link to submit them when the time comes. Your Research Paper will be submitted through a plagiarism-detecting package called SafeAssign. This is good for me, and good for you: it will give you a score noting how likely it is that there is plagiarized material in your work. You will have access to this score and can then adjust your paper (i.e. add citations) if need be.

- **CHECK IN TO BLACKBOARD OFTEN:** It is where you will find updated info, reminders about due dates and lots of useful information. Alternatively, make sure you will receive the Announcements from the Blackboard site to your everyday email address.

- There will be a ***required reading*** for each class. The reading is noted on this syllabus. It will indicate either a section of one of the textbook on our list, or I will provide a link or PDF for the reading. I also include a 'supplementary reading' folder in most class folders: these are for you to return to for the purposes of your Research Papers. Or, of course, if you are interested and want to follow up on a topic!

- Classes will be seminar-style: that means that there will be some lecture material and some discussion time. We will be discussing our readings in depth, and I will expect you to have questions, comments and thoughts to share about the readings and the scientific and philosophical theories we examine. The primary expectation, thus, is that you **DO THE READING.** I will call on you all randomly to explain the reading to the class, and we will be doing a series of discussion posts online that will be connected with the specifics of the readings.

- For many classes, I will be asking for volunteers to present summaries of the reading or, sometimes, to actually teach a concept or argument to your peers. These presentations are voluntary, but doing it is good teaching and verbal communication skills practice.

Required Textbooks and Other Course Materials:
The following texts are all available at the UTA Bookstore. They can be bought new or used, or rented, all at very reasonable prices:
http://www.bkstr.com/texasatarlingtonstore/home

(1) Richard DeWitt, *Worldviews: An Introduction to the History & Philosophy of Science*, First OR Second Edition, Wiley-Blackwell, 2010. ISBN: 978-1-4051-9563-8 **NB: First edition is cheaper, and readily available used online e.g. Amazon, and maybe in Half Price Books.**
(2) Philip Kitcher, *Living with Darwin*, OUP, 2007. ISBN: 978-0-19-538434-5. **NB: this is certainly available used on Amazon and perhaps HPB as well.**

Ask your peers who did the course last semester to sell/give you their text, or you can also rent them. Or you can check them out at Half Price Books, or on Amazon - just get your hands on whatever is the lowest cost for you.

I also recommend buying:
Anthony Weston, *A Rulebook for Arguments*, Hackett Publishing Company, 2010 (any edition is fine, though 4th is the latest: ISBN: 978-0-87220-954-1)- also available in the Bookstore. (This is not a required reading).

All other *required* reading material for this course will be provided by the instructor. The material will be posted on Blackboard.

Expectations for Out-of-Class Study: (**This is from the UTA Student Handbook**) "A general rule of thumb is this: for every credit hour earned, a student should spend 3 hours per week working outside of class. Hence, a 3-credit course might have a minimum expectation of 9 hours of reading, study, etc. Beyond the time required to attend each class meeting, students enrolled in this course should expect to spend at least an additional 9 hours per week of their own time in course-related activities, including reading required materials, completing assignments, preparing for exams, etc." This seems to me to be TOTALLY unrealistic! However, you should expect a minimum of an hour of outside class-time study for every hour in-class. So, set aside *at least* 3 hours a week for study outside of our class time (that is minimum).

Attendance and Participation
At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance.

As the instructor of this section, I will take attendance for each class, and I will take note of your participation. I don't expect every one of you to be as vocal as everyone else: some of you are quiet learners, and that is perfectly fine! But I can still tell if you are engaged and paying attention ☺. Moreover, I expect that you will not make every class, but please do your best to be there, and not to be late. (For UTeach students, I record all lectures, as you will miss some if you are assigned to go out and teach in the field). Up to three absences will be excused. I expect everyone to take part in discussions and debate (at your own comfort level), so be ready with questions and comments and ideas! This will be a fairly relaxed, fun class - so be prepared to speak up (and get outside your comfort levels for that matter).

While UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Blackboard. This date is reported to the Department of Education for federal financial aid recipients.

Evaluation
(1) Online Discussion Posts: 25%
(2) One lesson plan & presentation 25%
(3) One 3000 word (minimum) research paper 25%
(4) One exam 25%

Due dates for all assessments are noted on the Course Schedule available on Blackboard

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Online Discussion Board Posts
You will be required to respond to a prompt in an online discussion. Your post must be a minimum of 150 words. Each Discussion Board will be open for one week, and you have during that time to post. There will be up to 10 of these, but I will **only count your top 5 scores.** Each counted post will be worth 5 points, or 5% of your final grade. The top 5 scores will represent 25% of your final grade. You will find the Discussion Boards on our Blackboard website. Late Discussion Posts may be accepted if I am notified *before due date*.

Lesson Plan
Students will work in singles, pairs or triples and will be responsible for developing and presenting a 5E lesson plan together. The lesson plan will be designed to teach a science or math concept that integrates the *historical and/or philosophical issues* relevant to it. The historical and philosophical components are to be *well-integrated* into the lesson plans; not simply tacked on to the science or math. The target audience will be *your peers as teachers*. Original research is expected for the lesson plan, as per Specific Student Learning Outcome (4): *develop high quality research skills including a) searching for relevant materials, b) evaluating the provenance and reliability of resources, c) identifying resources specific to and available for teachers and d) finessing citation and bibliographic skills.*
The lesson plans will be presented to class during the final days of the semester. Fellow students will give feedback in the form of a 'peer review' of the draft. More details and specifications will be given out at a later date. The lesson plan and peer review, plus its presentation will count for 25% of the final grade. **LATE POLICY:** Late Lesson Plans will only be accepted with *a justified reason and documentation*. If you think you might not make it in time, PLEASE SEE ME BEFORE HAND if possible.

Mid-term Research Paper
Each student will write a Research Paper, minimum of 2000 words, on a topic in the history or philosophy of science or mathematics. The paper will need to be typed, double-spaced, and in a 12-point font with reasonable margins. Full and correct citations are required **in MLA format.** The topic will need to be cleared with the instructor early on – I will provide a list of sample topics/prompts to help you decide. Research papers will be peer-reviewed in class. Students MAY also hand in a draft for comment from the instructor (I will accept drafts up to 2 weeks before final due date, but no later). **This is recommended: in my experience, students who hand in a draft, and adjust their essays in response to the comments given, GREATLY IMPROVE THEIR FINAL GRADE.** The paper will count for 25% of the final grade**. LATE POLICY:** Late essays will only be accepted with *a justified reason and documentation*. If you think you might not make it in time, PLEASE SEE ME BEFOREHAND if possible. Late papers will be penalized points at the instructor's discretion.

This is a *research* paper. This means you will have to look up resources for your work. I provide some supplementary readings, but you should find *at least 3 readings* yourself through research in the library or online. I will provide help with research methods – just come and see me. Again, original research is expected for the Research Paper, as per Specific Student Learning Outcome (4): *develop high quality research skills including a) searching for relevant materials, b) evaluating the provenance and reliability of resources, c) identifying resources specific to and available for teachers and d) finessing citation and bibliographic skills.*

Exam
There will be an on-site end of semester examination consisting of one essay question and a series of short-answer questions. In order to answer the questions adequately, the student will not only need to be familiar with the reading and lecture material (i.e. some questions may arise in response to discussions had in class). It will count for 25% of the final grade. More information concerning expectations and evaluation criteria will be provided later. **Final exam to be held LS 101, Thursday Dec. 14, 11 – 1pm.**

Grading:
DISCUSSION BOARD POSTS: Up to 10 POSTS, each graded out of 100 points will be calculated as a percentage of 25% of your final grade. (**Only your top 5 results will be counted – you may choose how many posts you do**).
RESEARCH PAPER: 1 paper, graded out of 100 points. Peer reviews will be scored and calculated as a percentage of your final grade for the paper. Final score out of 100 points will be calculated as a percentage of 25% of your final grade.
LESSON PLAN: 1 Lesson Plan per pair/trio of students, peer feedback on Lesson Plans and Lesson Plan presentations will be scored and calculated as a percentage of 25% of your final grade.
EXAM: 1 on-site exam, graded out of 100 points. Final score out of 100 points will be calculated as a percentage of 25% of your final grade.

A 90-100%
B 80-89%
C 70-79%
D 60-69%
F 59% and below

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance**. The **last day to drop for Fall 2017 is Nov. 1st, by 4pm.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/aao/fao/).

Tentative Schedule & Important Dates

Course Dates: August 24 – December 6 (Exam week: Dec 11 - 14)

Be sure to visit our Blackboard pages *regularly.* Schedules may change, readings will go up and quizzes will be posted there so check it at least once a week. The following schedule may be subject to some adjustments as the semester progresses. These will be announced in class and posted on Blackboard. We will not be able to cover every topic and example listed under each lecture in equal depth.

Thu 08/24: Class 1: Introduction

Required Reading: The Syllabus!

'Relevance of PSM to Education Students' (in Class 1 folder).

1. Print out the Syllabus for the first class if you can. I will provide copies of the at-a-glance schedule. We will go though the syllabus, readings, class policies, assessments and scheduling issues, office hours etc.

2. You will also find in there: "PSM-Relevance". This is a document explaining to you a little of why this course is a good idea for you – even though you are aiming to become a teacher.

Our first topic is: What is Science? We will begin with a discussion of what, exactly, counts as 'science' – and do a survey on this. We will discuss the relevance and importance of the history and philosophy of science and math to science and math education. The survey results will be available for discussion for our next class.

NB: Always open the folder for the week AHEAD of you to have the readings done by the time of the relevant class. Don't leave it till the last minute – there is quite a lot of reading we need to get through.

So, be sure to open Class 2 folder as well, and do the required reading for next week.

SCIENCE AND MATH IN ANTIQUITY

We will begin with the question "What is Science"? This section will introduce us to the idea that what we call 'science' today is not a unified ready-made body of knowledge and method that has been handed down through the centuries. In particular, we will get acquainted with the idea that what is to count as 'science' is something that is up for question (including the asking ourselves whether *mathematics* counts as a science). What we count as 'science' depends on a good deal many assumptions about what counts as 'knowledge' or as epistemic authority. We then move to science and math in antiquity, examining how the ancients understood the study of nature, their theories and methods. Here, we will cover a wide swathe of history from the Egyptians and the Babylonians through to the mathematician Euclid. This general historical survey will focus here and there on specific theories, including some Pre-Socratics such as Thales, Parmenides and Zeno, the Atomists Democritus and Leucippus; the classical Greek Philosophers Plato and Aristotle, the mathematician Euclid and the astronomer Ptolemy. We will identify and analyze the key features of what we will understand to be the 'Aristotelian Worldview'. This will be contrasted, after a leap through history to the Scientific Revolution, with what we will understand as the 'Newtonian Worldview'. The different approaches to 'knowledge' and to the study of nature will be discussed in the context of teaching and learning science and math.

Tue 08/29: Class 2: What is Science?

Required Reading:

(1) Lindberg, David C., *The Beginnings of Western Science*, University of Chicago Press: Chicago, 2007 - 'Science before the Greeks', Chapter 1 (Online). (Hereafter BWS)

Topics and Discussion: What is Science? Is there a distinction between science and technology? Between science and art? Why do we need/want scientific and mathematical knowledge? Think about the results of our survey 'What is Science' from Class 1 – what do we *now* count as science and how do we distinguish it from non-science (e.g. humanities? Art?), or even pseudo-science (e.g. Astrology? Phrenology? Tea-leaf reading?) What are the

forces at work that might prevent the acceptance of some claims to scientific authority (e.g. climate science?) Is science better supported if it is underpinned by math? Is the idea of *measurement* important? But now: what is math? Is math a science?

We will talk about our intro to preliterate cultures and their approaches to knowledge of the world around them.

ASSESSMENT TASK: Do your first Discussion Board post. Click on Discussion Board #1 on BB for instructions. **Due by Sun 09/03 by midnight.**

Thu 08/31 Class 3: Pre-literate Cultures: what counts as 'science' and what counts as 'knowledge'?

Required Reading:

(2) Goldstein, M. & I.F. 'The Cultural Roots of Science' in *How we Know what we Know,* Capo Press, 1981, Chapter 8, pp. 260-275.

Topics and Discussion: 'Science', as an activity, as a human epistemic discipline has *evolved*. Discuss Lindberg's description of pre-literate tribes and their approach to what was to count as 'knowledge'. Discuss the Goldstein's comparison of science and witchcraft in relation to different cultural ideas about epistemic 'authority' and the acquisition of knowledge. We will connect this discussion of the evolution of what counts as 'science' with the thought that science and mathematics are not intellectual pursuits that are entirely independent of their historical and cultural contexts: this raises the question of the assumption of objectivity. We will discuss the rise, and role of, *skepticism* in science: with the development of *writing*. We discuss just what this innovation brought to the way the world around us was studied; who gets to be the 'epistemic authorities' and what 'knowledge' consists of.

Tue 09/05: Class 4: The Pre-Socratic Cosmos

Required Reading:

(1) Ede, A. & Cormack, L.B. *A History of Science in Society,* University of Toronto Press, 2012. Chpt. 1.

(2) Lloyd, G. *Early Greek Science: Thales to Aristotle*, W.W. Norton & Co., 1970, pp.45 ff.

(3) Handouts on Zeno's Paradoxes

Topics and Discussion: The Pre-Socratics; Thales, Heraclitus; the first Atomists: Leucippus and Democritus, the Pythagoreans. We will discuss the variety of Pre-Socratic views about number, change, the cosmos. In what ways were what they were doing 'science'? Why were these early Greeks able to separate the 'pure' study of nature or 'natural philosophy' from the technological, or practical aspects? What are the epistemological and pedagogical implications of these early 'ways' of doing science? We discuss the idea of the 'democratization of science' – by this time there was some, albeit minimal, separation of 'knowledge' from supernatural forces - necessary for the very *possibility* of developing skepticism about the views of the epistemic 'authorities'. We will discuss Parmenides and Zeno and the paradoxes of change and motion: 'Achilles and the Tortoise' and 'The Arrow' paradoxes of Zeno.

Activity (if time permits): we will divide into four groups and attempt to come up with solutions to Zeno's paradoxes. We will then compare and contrast the groups' independent responses.

ASSESSMENT: Discussion Board Post #2: Due Sunday 09/10 by midnight.

Thu 09/07: Class 5: Plato and Aristotle

Required Reading:

(1) Ede, A. & Cormack, L.B. *A History of Science in Society,* University of Toronto Press, 2012. Chpt. 1.

Topics and Discussion: Plato's Theory of Forms; Aristotle's natural philosophy, the 'Aristotelian' worldview- a new approach to natural philosophy in which we begin to see an enormously reduced role for the supernatural realm

and a focus on the concept of proof and deduction. We will discuss Plato's Rationalism, and Aristotle's syllogistic logic - the first system of deductive proof. We will look at Aristotle's view that scientific knowledge was to be acquired by the 'inductive-deductive' method, and we will compare the methods of *induction* and *deduction*.

Tue 09/12: Class 6: Introduction to "Worldviews"

Required Reading:

(1) Dewitt, Richard, *Worldviews: An Introduction to the History and Philosophy of Science*, Wiley-Blackwell: Oxford. 2010: Chpts. 1, 3, 4 and 8. (Hereafter 'Worldviews').

Topics and Discussion: We will become familiar with DeWitt's 'worldview' interpretation of the history of science, beginning with his account of the Aristotelian worldview. We will become familiar with the distinction between *empirical* and *conceptual* evidence and support for theories and the difference between *confirming* and *disconfirming* evidence.

ASSESSMENT: Discussion Board Post #3: Due Sunday 09/17 by midnight.

Thu 09/14: Class 7: Aristotle to Ptolemy

Required Reading:

(1) Worldviews, Chpts. 9 & 10

Topics and Discussion: We examine more closely the elements of the Aristotelian Worldview, and in particular, we will look at the astronomical theory prevalent at the time: Ptolemy's. We will see how this astronomical theory reflects all of the elements of the Aristotelian Worldview.

Be sure to check which group you are in on BB for your Lesson Plans. Start working out what your lesson is going to be.

Tue 09/19: Class 8: Ptolemy and Copernicus

Required Reading:

(2) Worldviews, Chpts. 11 through 14

Topics and Discussion: We will examine Ptolemy's astronomical system as an example of how science moves beyond the philosophical and conceptual frameworks within which it arose. We compare Ptolemy's and Copernicus' astronomical systems as examples of the kinds of philosophical and conceptual changes needed for science to advance. We will become more familiar with the idea of understanding a scientific theory *instrumentally* versus *realistically.*

Activity: we will compare the astronomical systems of Ptolemy and Copernicus: did they both have "good evidence" for their views? Were there differing social and cultural factors influencing their work? Do we have 'proof' of one over the other today?

ASSESSMENT: Discussion Board Post #4: Due Sunday 09/24 by midnight.

Thu 09/21: Class 9: Ptolemy to Newton

Required Reading:

(1) Worldviews, Chpts. 17 through 20

Topics and Discussion: Now we will take a leap through history to Newton. We will examine some of the major changes in thinking about and doing science and math in the Scientific Revolution – and find out why it was called a 'revolution'. Taking this leap will demonstrate the shift from the Aristotelian worldview to the Newtonian, and thence to modern day approaches to science. In this time-span, the teaching and learning of science and math have changed too: in what ways? In what ways do the systems and methods of Aristotle and Newton differ? Can we now say more about the inductive/deductive comparison? Why does experimentation make so much difference to the validity of a theory?

LOGIC & THE FOUNDATIONS OF MATHEMATICS

We now shift attention to formal logic and its importance in the development of scientific method and its connections with the foundations of mathematics. We will be introduced to the basic concepts of logic, learn a first-order calculus and discuss some issues in Proof Theory, including Aristotelian Syllogistic and developments in Natural Deduction. In this section, we will come to understand the idea of an axiomatic system of proof, how it developed historically from Euclid to Hilbert, and how it features in thinking about scientific knowledge. We will examine how closely these foundations of math and logic are tied in with the foundations of science–both historically and philosophically.

Tue 09/26: Class 10: Intro to the Axiomatic Method

Required Reading:

(1) BWS, Chapter 5, pp. 82 – 86.

(2) Euclid's proof - on Blackboard (*The Elements* – open-source)

(3) Notes on the Axiomatic Method – Handout (Blackboard)

Topics and Discussion: The mathematical sciences in antiquity; Plato's rationalism; Euclid's innovations and the 'axiomatic' method. This 'proof-based' approach formed what we will call the 'Aristotelian' world-view. Here we mark the development of the idea that knowledge *proper* had to be based on *reason* and on *deduction,* with the axiomatic method developed for mathematical proof standing as the ideal. Why do we value such 'proofs'? What about claims that cannot be 'proven'? We will begin a (longer) discussion about comparing *inductive* knowledge and methods with *deductive* knowledge and methods. We will also begin a discussion that we will return to; what is the connection between 'truth' and 'proof', in science, math and elsewhere?

Activity: together we will work through Euclid's proof that there are infinite prime numbers and his proof that the sum of the internal angles of any triangle is 180 degrees.

Make sure you have chosen your Research Paper topic this week, and see me about it.

09/28: Class 11: Intro to informal logic

Required Reading:

(1) Weston, Anthony, *A Rulebook for Arguments*, Hackett Publishing: Indianapolis, 2009 - Chapter VI, pp. 37-45. (Recommended textbook-but also available on Blackboard)

(2) Perry, John; Bratman, Michael & Fisher, John Martin (Eds.), *Introduction to Philosophy*, 6th Edition, OUP: Oxford, 2013 - 'Logical Toolkit' (see Blackboard)

(3) Gensler, Harry J., *Introduction to Logic*: Intro to the logical fallacies (see Blackboard)

Topics and Discussion: Introduction to some *informal* logic. Here we look at arguments that *look* valid, but turn out to be *fallacious*. How not to be taken in by such reasoning! How to construct valid and sound arguments of your own!

Activity: We will examine some fallacious argument forms, then we will break up into groups to work on discovering the fallacies in a number of short texts.

ASSESSMENT: Discussion Board Post #5: Due Sunday 10/01 by midnight.

Tue 10/03: Class 12: How to Write a Research Paper

Topics and Discussion: This class will focus entirely on how to research and write a college essay. We will go over form, how to find resources and how to cite sources. We will get familiar with the basic structure of an essay, transitional phrases and how to develop your thesis from an initial *thesis statement.*

Over the next 3 week, you will write your RP draft (minimum of 1000 words), which you will bring in to class *anonymised* for peer review on THU 10/26.

Thu 10/05: Class 13: Intro to the propositional calculus

Required Reading:

(1) Harry J. Gensler, *Introduction to Logic* Chpt 3: Propositional Logic (see Blackboard)

Topics and Discussion: Symbolizing arguments; the truth-functional connectives, truth tables. Using truth tables to test arguments for validity.

Activity: some take-home logic proofs to do for homework. Students will assess each-others' proofs next class.

Tue 10/10: Class 14: Finish Prop. Calc.

Required Reading:

(1) Harry J. Gensler, *Introduction to Logic* Chpt 3: Propositional Logic (see Blackboard)

Activity: We will assess some proofs from last class.

Thu 10/12: Class 15: The Philosophy of Math

Required Reading: TBA

Topics and Discussion: Here we will discuss some of the basic philosophies of mathematics: Formalism & Platonism. At issue is how we view the status of numbers: do they 'really' exist, just like apples and oranges, for example? Or are they projections onto reality by the mind (in some sense)? We will also focus on the issue of how we come to *know* about numbers, and other mathematical objects.

Activity: We will listen to a documentary on a tribe in South America, which has no words for numbers – only the quantities 'a', 'a few' and 'many'. We will discuss the implications of this for the notion of 'innateness' about knowledge of numbers; and indeed, the claim that numbers are objective.

Continue drafting your research paper. See me for ideas on resources if you need to. Don't leave this paper until the last minute!

EPISTEMOLOGY & METHODOLOGY IN SCIENCE AND MATH

We will narrow our focus to the special problems of human knowledge, and in particular the problem of what is to count as 'scientific knowledge'. At this point we will look more carefully at the method of induction and various views about the concept of scientific confirmation. We will look at issues in scientific methodology through the lens of some particular sociological issues in science. We will look again at the role of skepticism – this time in connection with modern critical thinking. This study of scientific methodology leads us to Bayes Theorem and probabilistic reasoning, and its use in modern science.

Tues 10/17: Class 16 AND Thu 10/20 Class 17: Truth & Knowledge in Science and Math/ Quine-Duhem Hypothesis

Required Reading:

Worldviews, Chpts. 2, 5, 6, 7.

Topics and Discussion: We assume that scientific investigation provides us with the true picture of reality: but what is 'truth'? Moreover, how are we to define 'knowledge'? Both seem particularly pressing if we think that science is to provide both. We discuss some theories and issues concerning these concepts. Then we turn to one theory about the connection between science, knowledge and truth: the Quine-Duhem Hypothesis. This leads into a discussion of the status of science itself.

Th 10/19: Class 18: Equality in Science and Math

Required Reading: TBA

Topics and Discussion: We will read about, and discuss, some more focused issues in the sociology of science, including a discussion of equal opportunity in math and science careers, and Feminist issues. What thoughts about the teaching and leaning of science and math do these considerations raise? Do sociological issues affect pedagogy in general, and if so, how?

Activity: we will think about, discuss and make a list of ways of overcoming the obstacles to engaging in STEM careers women and other under-represented groups encounter.

Tue 10/24: Class 19:

Special Class for peer review of essay drafts: bring in your draft today – anonymized – just your student number on it please.

Note that next Tuesday Oct. 31 is the last day I will accept drafts for comments.

Th 10/26 Class 20:

Special Class reserved for Lesson Planning: get in your groups and work on your plan in class.

Tue 10/31 Class 21: Bayesian Probability 1

Required Reading:

(1) Godfrey-Smith, Chapter 14, pp. 202-217.

Topics and Discussion: We will read about, and discuss, the theory of probability and Bayes Theorem. Does this solve our problem of how scientific theories can have authority, even without provability?

Activity: Paradoxes and problems in probability: game-theory and gambling; the Prisoner Dilemma; the Two-Envelope paradox and others.

ASSESSMENT: Discussion Board Post #6: Due Sunday 11/05 by midnight.

Thu 11/02: Class 22: Bayesian Probability 2

Required Reading:

(1) Godfrey-Smith, Chapter 14, pp. 202-217.

Topics and Discussion: We will read about, and discuss, the theory of probability and Bayes Theorem. Does this solve our problem of how scientific theories can have authority, even without provability?

Activity: Paradoxes and problems in probability: game-theory and gambling; the Prisoner Dilemma; the Two-Envelope paradox and others.

RESEARCH PAPER DUE: SUNDAY NOV. 12 BY MIDNIGHT: ONLINE PLEASE.

DARWIN AND THE THEORY OF EVOLUTION

Here we will take a careful look at Darwin and the theory of Evolution, with particular attention to Natural Selection, Undirected Variation and common ancestry. We will think about and discuss some issues in teaching evolution in schools, about how and why it ought to be taught; and we will think about evolution theory in terms of what we have previously learned about the developments and changes in scientific methodologies.

Thu 11/07: Class 23 through Thu 11/16: Class 26: Darwin and the Theory of Evolution

Required Reading:

(1) Worldviews, Chpts. 27 & 28

Topics and Discussion: We will spend 3 classes reading this book and discussing the theory of evolution as a case-study in what we have learned about the history and philosophy of science and math so far.

ASSESSMENT: Discussion Board Post #7: Due Sunday 11/19 by midnight.

LESSON PLAN PRESENTATIONS

Tue 11/21: Class 26, (NB: Th 11/23: THANKSGIVING – NO CLASS), Tue 11/28: Class 27 and Th 11/30: Class 28

All students will present their lesson plans.

LAST CHANCE! **ASSESSMENT: Discussion Board Post #8: Due Sunday 12/03 by midnight.**

REVIEW WEEK:

Tue 12/05: Class 29 Last Class: We will review the semester's topics and prepare for the exam.

EXAM: Dec 12 – Dec 16

On site exam: held LS 101, Thursday Dec. 14, 11 – 1pm.

Disability Accommodations: UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including *The Americans with Disabilities Act (ADA), The Americans with Disabilities Amendments Act (ADAAA),* and *Section 504 of the Rehabilitation Act.* All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of **a letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting:

The Office for Students with Disabilities, (OSD) www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.

Counseling and Psychological Services, (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: *The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos.*

Title IX Policy: The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit* www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.

Academic Integrity: Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

> *I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*
>
> *I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University. Additional information is available at https://www.uta.edu/conduct/.

SO: please do not copy from other sources without citing them. This includes internet sources, other student's essays, articles etc. This is plagiarism, and is easily detected. I will include links to style guides on Blackboard, so you can master a system of citing sources that works for you. I am also happy to help you with a citation style, just ask me. See the following tutorial provided by the Library: http://library.uta.edu/plagiarism/index.php

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at http://www.uta.edu/oit/cs/email/mavmail.php.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit http://www.uta.edu/news/info/campus-carry/

Student Feedback Survey: At the end of each term, students enrolled in face-to-face and online classes categorized as "lecture," "seminar," or "laboratory" are directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback via the SFS database is aggregated with that of other students enrolled in the course. Students' anonymity will be protected to the extent that the law allows. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit http://www.uta.edu/sfs.

Final Review Week: for semester-long courses**,** a period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at http://www.uta.edu/universitycollege/resources/index.php.

University Tutorial & Supplemental Instruction (Ransom Hall 205): UTSI offers a variety of academic support services for undergraduate students, including: 60 minute one-on-one tutoring sessions, Start Strong Freshman tutoring program, and Supplemental Instruction. Office hours are Monday-Friday 8:00am-5:00pm. For more information visit www.uta.edu/utsi or call 817-272-2617.

The IDEAS Center (2nd Floor of Central Library) offers **free** tutoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. To schedule an appointment with a peer tutor or mentor email IDEAS@uta.edu or call (817) 272-6593.

The English Writing Center (411LIBR): [Optional.] The Writing Center Offers free tutoring in 20-, 40-, or 60-minute face-to-face and online sessions to all UTA students on any phase of their UTA coursework. Our hours are 9 am to 8 pm Mon.-Thurs., 9 am-3 pm Fri. and Noon-6 pm Sat. and Sun. Register and make appointments online at http://uta.mywconline.com Classroom Visits, workshops, and specialized services for graduate students are also available. Please see www.uta.edu/owl for detailed information on all our programs and services.

The Library's 2nd floor Academic Plaza offers students a central hub of support services, including IDEAS Center, University Advising Services, Transfer UTA and various college/school advising hours. Services are available during the library's hours of operation. http://library.uta.edu/academic-plaza

Library Home Page library.uta.edu

Resources for Students

Academic Help

Academic Plaza Consultation Services library.uta.edu/academic-plaza

Ask Us ask.uta.edu/

Library Tutorials library.uta.edu/how-to

Subject and Course Research Guides libguides.uta.edu

Subject Librarians library.uta.edu/subject-librarians

Resources

A to Z List of Library Databases libguides.uta.edu/az.php

Course Reserves pulse.uta.edu/vwebv/enterCourseReserve.do

FabLab fablab.uta.edu/

Special Collections library.uta.edu/special-collections

Study Room Reservations openroom.uta.edu/

Undergraduate Research Skills Instruction, Gretchen Trkay gtrkay@uta.edu or your subject librarian.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Evacuation plans may be found at http://www.uta.edu/campus-ops/ehs/fire/Evac_Maps_Buildings.php. Please take the time to view: Emergency/Fire Evacuation Procedures (http://www.uta.edu/police/EvacuationProcedures.pdf)

Students should also be encouraged to subscribe to the MavAlert system that will send information in case of an emergency to their cell phones or email accounts. Anyone can subscribe at https://mavalert.uta.edu/ or https://mavalert.uta.edu/register.php

Emergency Phone Numbers: In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. Non-emergency number 817-272-3381