GISAT 160—Syllabus—Fall 2008  
Problem Solving in Science and Technology

# What’s this course about?

## What the JMU Catalog says…

This course examines issues in modern science and technology as a means to introduce, develop, and enhance critical thinking and problem solving skills. Current scientific and technological research and workplace-related problems will be introduced to reinforce problem solving, instruction in systems thinking, and critical inquiry. The course provides opportunities for using both oral and written communication in a variety of learning activities.

The goal of this course is to help you get better at:

* Thinking,
* Reading,
* Writing, and
* Speaking

about real world problems in science and technology. This course is designed to make you better able to do things like:

* Converse intelligently about the real impacts of global climate change, and make informed decisions relating to who to vote for, whether or not to buy a hybrid car, or how to save money on utility bills.
* Convince your mom and dad why your video game habit is really going to help you get a job as a surgeon.
* Help you tell fact from fiction when the pharmaceutical industry buys time during the Super Bowl to try to sell you the latest and greatest cure for attention deficit disorder (ADD), insomnia, or erectile dysfunction (ED).
* Figure out why you spent so much time in school taking standardized tests, what those scores mean, and what in fact the No Child Left Behind (NCLB) Act is supposed to prevent kids from getting left behind by.
* Understand how to leverage the power of your iPhone and other mobile devices and technology to solve a whole host of problems, some of which we haven’t even discovered yet.

In short, this course is designed to help prevent you from being fooled, and being made a fool of, by people who use a lot of really highfalutin, sophisticated-sounding, scientific and technical jargon. It’s about equipping your brain to deal with the barrage of “scientific” claims that get hurled at you daily in modern society.

# What you will do in this course…

Discuss. Struggle. Debate. Criticize. Question. Collaborate. Analyze. Challenge. Explain. Think. Write. Evaluate. Participate.

# What you will NOT do in this course…

Sit passively and listen to lectures.

# Okay, what will we *really* study in this course?

## Cluster One Course Objectives

* Evaluate claims in terms of clarity, credibility, reliability, and accuracy
* Demonstrate the ability to identify, analyze and generate claims, arguments, and positions
* Identify and evaluate theses and conclusions, stated and unstated assumptions, and supporting evidence and arguments
* Apply these skills to one's own work and the work of others

## Outline of Course Content (may change slightly)

This class is divided into four areas of study; below is a very brief description of each.

1. Critical Reasoning and Close Reading
   1. Critical Reasoning / Logic  
      Students learn basic practical critical reasoning skills and methods primarily through the analysis of language in scientific and technological articles, and how this approach to thinking is central to application in science and technology.
   2. Close Readings / Critical analysis of written texts
      1. Clarity of writing, ambiguity and vagueness, accuracy, detail, specificity, authorial intent
      2. Analysis of arguments
      3. Constructing arguments
2. Systems Thinking / Complex Systems
   1. *Systems Thinking*  
      “...the ability to see the world as a complex system, in which we understand that 'you can't just do one thing' and that 'everything is connected to everything else'” (from Sterman, *Business Dynamics*)
   2. *Complex Systems*  
      the study of the unpredictable results which result when a variety of simple things interact in simple ways…and their influence on such topics as science, technology, economics, the environment, mechanical systems, and virtually every field of human endeavor.
   3. Students learn to define and solve problems in science and technology through employing a systems thinking approach.
      1. Analysis of complex systems
      2. Construction of systems-related solutions
      3. Construction of simple single and double loop diagrams
3. Problem Solving  
   Students learn fundamental linear and non-linear problem solving strategies in technological and scientific contexts. Problem solving techniques:
   1. Structured problem solving
   2. Brainstorming
   3. Writing as thinking
   4. Reflection
   5. Induction / Deduction
   6. Free writing
   7. Mind mapping (computer generated)
4. Problem Solving and Technology  
   Instruction focuses on defining the role of technology in generating and exploring ideas in the context of the problem solving process. The computer as a tool for problem solving:
   1. Technology as a *conduit* for collecting information
   2. Technology as a *bank* for storing and organizing information
   3. Technology as an *engine* for exploring information
   4. Technology as a *communication medium* for current and historical research

# What are the textbooks in this class?

There is only one required text:

Browne, N., Keeley, S. M. *Asking the Right Questions: A Guide to Critical Thinking* (8th Edition). Prentice Hall. 2006.

There are also some recommended readings. Do NOT buy these (unless you really want one):

Chaffee, John. *Thinking Critically.* Princeton, N.J: Houghton Mifflin Company, 1994

Flage, Daniel. *The Art of Questioning*. Upper Saddle River, N.J.: Prentice Hall. 2004.

Hayakawa, S.I. *Language in Thought and Action*. New York: Harcourt Brace Jovanovich. 1990.

Senge, Peter. *The Fifth Discipline*. New York: Doubleday, 1990.

Sterman, John D.  *Business Dynamics: Systems Thinking and Modeling for a Complex World*. New York: McGraw-Hill/Irwin. 2000.

Adams, James. *Conceptual Blockbusting*. Cambridge, Mass.: Perseus Publishing. 2001

Petroski, Henry. *To Engineer is Human:* *The Role of Failure in Successful Design*. New York: Vintage Books. 1995

Perelman, Leslie. *Technical and Scientific Writing*. London: Mayfield Publishing Company. 1998.

Adler, Ronald and George Rodman. *Understanding Human Communication*. New York: Holt, Rinehart, and Winston, Inc. 1988.

# How you will be graded…

The following is a rough breakdown of how grades will be assigned. It is subject to change. I will usually consult you before making changes, but I reserve the right to make the final decision.

|  |  |
| --- | --- |
| Activity | % of Grade |
| Attendance | 10% |
| Participation | 20% |
| Critical Reading Project | 10% |
| Research Paper and Presentation | 20% |
| Team Project(s) and Presentation | 20% |
| Homework | 10% |
| Final Exam | 10% |

Please note that together attendance and participation make up 30% of your grade!!! There is nothing more important than showing up and being alive when you get there. If for some reason you feel that showing up for class is not a valuable use of your time, you better let me know about it ASAP!

# How you will be evaluated…

Grading is the process of assigning an abstract number to represent your “performance” in the class. It’s a rather fuzzy and usually unscientific process, and its major customer is the JMU registrar, and perhaps an employer down the road. However, what should be important to you right now is how you are evaluated. Evaluation is the process of providing you concrete, constructive, actionable feedback on your performance. Good grades get you a diploma. Good evaluations get you everything else. Here’s how you will be evaluated:

## Peer Evaluation

I’m a big believer in peer evaluation. Peer evaluation does NOT mean peer grading. We will spend a lot of time reading each other’s work and providing rich feedback. Becoming a good reviewer of other people’s work will be one of the most marketable skills you acquire in this class.

## Instructor Evaluation

In this course, I practice a form of evaluation called “comment-only marking.” What this means is that although I am writing down a grade in my gradebook, I will NOT tell you what it is. If you care a lot about grades, and hate to make judgments on your own, you will probably not like this. Don’t worry, though. You will grow to appreciate it. ☺ Of course, at some point I will tell you what your grades are, but it will probably be just about the time you’ve stopped caring whether or not you know.

## Self Evaluation

Have you drunk a lot of coffee? Do you know the difference between really “good” coffee and “bad” coffee? Part of building your personal skill in any area is continually practicing and asking yourself this question “Is this any good?” If you can’t tell the difference between good work and bad work, then you will never be able to produce consistently good work because…how would you know? Developing a keen sense of Quality is a big part of becoming successful. Self evaluation is the most important form of evaluation in this (and any) course.

# Can I redo assignments I’m not happy with?

Yes. If you are not happy with the evaluations you get, you can redo any assignment. There are a couple of rules that apply though:

1. **You must make a good effort to do the assignment the first time.**  
   The freedom to redo an assignment is NOT freedom to half-ass it the first time knowing you can “fix” it later.
2. **You must turn the assignment in on time.**  
   The freedom to redo does not apply if you turn in the first effort late.

I allow people to redo assignments because I want to reward you for taking the time and effort to improve your knowledge and abilities.

# What are the other course policies?

## Attendance

Woody Allen said, “Eighty percent of success is showing up.” Well, you won’t get 80% of your course grade for showing up, but let’s just say your instructor thinks it’s VERY important. Individually you will lose points for being late or absent. There will be a 2% bonus for the team with the best overall attendance for the semester. Therefore, you are encouraged to support your team members. If they are consistently late or absent, check in on them. Find out what’s keeping them away and if there’s anything you can do to help them out.

## Honesty and Integrity

I have a ZERO tolerance for any forms of dishonesty, verbal, written, or otherwise. I’m a pretty laid back guy, and I will, in a very laid back manner, refer your honor violations to the appropriate authorities at JMU to deal with as they see fit. This applies to ALL of your interactions with me and your fellow classmates throughout the semester, regardless of whether you have written out the honor pledge and signed it or not. This class can only work when we trust each other. I take it pretty seriously when someone violates that trust.

## Participation

It pretty much goes without saying that participation is crucial to success in this class.

# What if I’ve got a problem with the professor?

Ouch! Okay, well, it happens. If I’ve made you upset for some reason there are several ways you can deal with it:

1. Please feel free to come talk to me about it. I don’t have posted office hours, but I’m here pretty much all of the time except for Friday afternoons. You also have [access to my Google calendar](http://www.google.com/calendar/embed?src=morgan.benton%40gmail.com&ctz=America/New_York&pvttk=88fc38002e9de1ffc13d0f8446be94dc). I keep it up to date and it should let you know when I’m free.
2. Once we get to know each other better, we’ll elect a class ombudsman. This person will be one of your classmates through whom you can send messages to me anonymously.
3. Midway through the semester we’ll have a TAP (Teaching Analysis Poll) which is designed to let you air out your concerns in a non-threatening environment via a neutral 3rd party.
4. If things get really bad you can go see the course coordinator for GISAT 160, Dr. Eric Pappas, or my boss, Dr. Pauline Cushman, head of the ISAT department, both of whom will know how to bring me into line.

Yikes! I hope none of this is necessary.

# What is the schedule of topics for the semester?

I borrowed this list from another professor who teaches this class. It may be subject to change as I learn more about you and more about how I think this class should go.

|  |  |  |
| --- | --- | --- |
| Week | Date | Topic(s) |
| 1 | 8/26 | Introduction to critical reason, problem solving, and class policies |
| 2 | 9/2 | Thinking skills in life and work; Lifestyle and Thinking |
| 3 | 9/9 | Logic, critical reasoning and language, sentence-level analyses (clarity, ambiguity, vagueness, authorial intent); Dualistic thinking |
| 4 | 9/16 | More on logic and argumentation |
| 5 | 9/23 | Textual analysis and close readings |
| 6 | 9/30 | Close readings continued / Introduction to Systems Thinking |
| 7 | 10/7 | Systems Thinking / Complex Systems |
| 8 | 10/14 | Systems Thinking / Complex Systems |
| 9 | 10/21 | Linear problem solving |
| 10 | 10/28 | Non-linear problem solving |
| 11 | 11/4 | Non-linear problem solving |
| 12 | 11/11 | Computer mind-mapping |
| 13 | 11/18 | Problem solving and technology |
| 14 | 12/2 | Class presentations |
| Final | 12/9 | 10:30-12:30 |

# Geez, so who is responsible for all of this?

Well, in addition to you, that would be me:

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