Research Methods Spring 2014
Biology/Chemistry/Earth & Environmental Science/Physics 3091

Tues/Thurs 3:30-5:00; Lab Tues 5:30-7:00
Bio-Life Building Room 129

NOTE: Syllabus subject to change; check Blackboard to be sure you have the most recent edition.

Instructor:
Douglas Baird, Ph.D.
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Office Hours: Wednesdays 9:30-11; Fridays 1:30-3, Barton A321-office or Barton A306-TUteach Studio

Dr. Baird has served as an instructor in Research Methods since 2011, and as a Co-director of Temple's TUteach program since 2008. Since 1994, Dr. Baird has directed laboratory and lecture courses for undergraduate, graduate and medical students. From 1993 – 2002, Dr. Baird directed a developmental neuroscience research laboratory at what is now Drexel College of Medicine, funded by NIH, and the March-of-Dimes and Whitehall foundations. In addition to numerous publications in the field of neuronal development, Dr. Baird's first scientific paper described the development of a mathematical model of honeybee behaviors related to rearing queen bees, published when he was a doctoral student. Dr. Baird helped develop Temple's ExxonMobil Summer Science Camp for middle school students, and helped direct the camp, 2008-2012.

Graduate Teaching Assistant:
Brandon Presley
bcp@temple.edu
Office hour: Thursdays from 5-6PM, Bio-Life 129.

Brandon holds a bachelors degree in chemistry from Temple, and is a student in Temple's chemistry doctoral program. Brandon has performed several research experiments in various branches of chemistry including analytical, organic and inorganic chemistry. His current research deals with the analysis of synthetic cannabinoid drugs. Brandon has extensive experience tutoring and mentoring K-12 students in science and mathematics. He is currently employed as a forensic chemist at NMS Labs in Willow Grove, PA.

Accommodation of Disabilities
If you need an accommodation based on the impact of a disability please contact Dr. Baird privately to discuss the specific situation as soon as possible. Contact Disability Resources and Services at (215) 204-1280 in 100 Ritter Annex to coordinate reasonable accommodations for students with documented disabilities.

1. Introduction:
Research Methods is a required, one-semester, three-credit course in Temple's TUteach science and mathematics teacher training program, and is also required for the bachelor's degree in

Natural Science. It is one of several content courses specially designed to meet the needs of future teachers (others include Perspectives on Science and Mathematics, and Functions and Modeling). Sections meet three hours per week for non-traditional, interactive presentations and two hours per week for lab. The course is cross-listed in Physics, Chemistry, Earth and Environmental Science, and Biology.

The goals of the course are: to provide you with the tools that scientists use to solve scientific problems; to give you the opportunity to use these tools in a laboratory setting; to make you aware of how scientists communicate with each other through peer-reviewed scientific literature; and to enable you to understand how scientists develop new knowledge and insights, the most important of which may eventually be presented in textbooks and taught in conventional science classes.

In this course you will design and carry out four independent inquiry activities, which you will write up and present in the manner of scientific research papers. The inquiries must incorporate mathematics as well as at least one of the science disciplines. The team of instructors associated with this course have expertise in different disciplines so as to advise students in various majors on planning and carrying out their inquiries in the lab. A graduate extern and other guest faculty are also members of the instructional team.

The combination of Research Methods and Perspectives on Mathematics and Science provides prospective science and mathematics teachers with an in-depth understanding of how the scientific enterprise works.

2. Course Requirements:
This is largely an experiential-learning course. Therefore attendance is required and will be enforced by taking roll. A grade of "Incomplete" may be assigned in cases of more than three absences.

The course textbooks will be Research Methods by Michael P. Marder, Uncle Tungsten by Oliver W. Sacks, and Surely You're Joking Mr. Feynman by Richard P. Feynman. All three will be provided as pdf files via Blackboard, subject to accompanying terms and conditions for legal use. Copies of all three books are also available at the TUteach Studio, Barton A306. **In addition you must buy a lab notebook**, **Staples item 567644, for $16.99 (or similar) and bring it to the lab on 1/28.**

I will periodically put supplemental, recommended readings on reserve, for example "The Ten Most Beautiful Experiments" by George Johnson. Supplemental readings are not required, but may be helpful or of interest.

Course Grades will be determined using the "rubric" (pre-defined list of requirements) given below. This is a widely recommended, "modern" teaching method that should help you improve your performance if you refer to the rubric during the course of the semester.

Course Grade Rubric
Course Grade Scale: 94-100 = A, 90-93 = A- , 87-89 = B+, 84-86 = B, 80-83 = B-, 77-79 = C+,

74-76= C, 70-73 = C-, 67-69 = D+, 64-66 =D, 60-63=D-; below 60 = F.
Work turned in late will lose 10% of its value for each calendar day that it is late.
Each of your final inquiry written reports will be graded using a rubric that you will receive in advance. **Review of the specific assignment rubric in advance of attempting each assignment should help you earn a better grade.** In addition, final drafts of Inquiries 1, 2, and 3 that have been turned in on time can be rewritten for additional credit. Details of this policy will be announced later.

The final inquiry (#4) subject must be drawn from the discipline in which you enrolled in the course. In other words, if your roster shows this course as Biology 3091 then your final inquiry must be related to biology.

Activity		Points
Attendance		10
Homework		25
Inquiry 1		5
Inquiry 2:	Proposal	2
	Draft (Must be on time to get points)	3
	Oral Presentation	3
	Final Writeup (Must maintain timeline to get points)	10
Inquiry 3	Writeup	10
Inquiry 4:	Proposal	2
	Draft (Proposal must be on time to get draft points)	5
	Oral Presentation	5
	Final Writeup (Must maintain timeline to get points)	15
Debate Presentation		5
	Total:	100

Note: "Debate presentation" grade is based on your oral presentation of an open question of your choice, typically a question that impacts the lives of many, and/or is of interest to many scientists or mathematicians.

There will be no final examination as such in this course. Your written report on your final inquiry, Inquiry 4, will be due on the last day of final examination week (see course calendar for specific date). The final exam period for this course, **Tuesday May 13th, 1-3PM** will be used for oral presentations by students on their Inquiry 4 projects. **Please make plans to remain on campus through finals week, as your grade on Inquiry 4, will include your performance on this presentation.**

Course Schedule
The course meets three sessions per week, two for activities/discussion and one for lab. The

schedules of topics and readings for lectures and labs are included in the course calendar, along with dates readings and homework are to be assigned, and dates assignments are due.

Academic Honesty (from Undergraduate Bulletin)
"Temple University believes strongly in academic honesty and integrity. Plagiarism and academic cheating are, therefore, prohibited. Essential to intellectual growth is the development of independent thought and a respect for the thoughts of others. The prohibition against plagiarism and cheating is intended to foster this independence and respect.
Plagiarism is the unacknowledged use of another person's labor, another person's ideas, another person's words, another person's assistance. Normally, all work done for courses -- papers, examinations, homework exercises, laboratory reports, oral presentations -- is expected to be the individual effort of the student presenting the work. Any assistance must be reported to the instructor. If the work has entailed consulting other resources -- journals, books, or other media -- these resources must be cited in a manner appropriate to the course. It is the instructor's responsibility to indicate the appropriate manner of citation. Everything used from other sources -- suggestions for organization of ideas, ideas themselves, or actual language -- must be cited. Failure to cite borrowed material constitutes plagiarism. Undocumented use of materials from the World Wide Web is plagiarism.

Academic cheating is, generally, the thwarting or breaking of the general rules of academic work or the specific rules of the individual courses. It includes falsifying data; submitting, without the instructor's approval, work in one course which was done for another; helping others to plagiarize or cheat from one's own or another's work; or actually doing the work of another person."

The penalty for plagiarism or academic dishonesty for this course can vary from receiving a reprimand and a failing grade for a particular assignment, to a failing grade in the course, to suspension or expulsion from the university. The penalty varies with the nature and severity of the offense and number of offenses. Students who believe that they have been unfairly accused may appeal through the college's academic grievance procedure.

Learning Objectives
Pre-college teachers are more or less universally required to formulate lesson plans based on "learning objectives" which are usually keyed to content requirements laid down by the state or the school district. Teachers are increasingly evaluated (and even paid!) based on their students' attainment of these objectives, as indicated by "evidence" from "assessments" performed in connection with the course.

This course has "learning objectives" for you, which have been specifically crafted to allow you to learn how to perform and present research and also make you a better science teacher. Completion of the assignments in the course will provide the "evidence" of how well you have attained these objectives. The objectives and evidence for Research Methods are summarized below.

1. Objective: Students can create their own experiments to answer scientific questions. Evidence: Four papers on four separate independent inquiries, designed and carried out by the student: (1) brief home inquiry, (2) laboratory inquiry using "high-end high school equipment," (3) survey involving human subjects, and (4) extended laboratory inquiry

2. Objective: Students can design experiments to reduce systematic and random errors and use statistics to interpret the results. Evidence: Papers on inquiries 2, 3, and 4; proposals for inquiries 2 and 4.

3. Objective: Students can use probes and computers to gather and analyze data. Evidence: Instructor observations during inquiries 2 and 4.

4. Objective: Students can use statistics to interpret experimental results and deal with sampling errors. Evidence: Two homework assignments; two brief in-class papers; class performance; write-ups for inquiries 2, 3, and 4.

5. Objective: Students know how to treat human research subjects in an ethical fashion. Evidence: Completion of certificate for the human subjects training required of Temple researchers by the University's Institutional Review Board; satisfactory completion of inquiry 3, which involves human subjects.

6. Objective: Students apply safe laboratory procedures. Evidence: Instructor observations during inquiries 2 and 4.

7. Objective: Students can find and read articles in the scientific literature. Evidence: Two homework assignments; performance assessment during debate.

8. Objective: Students can create mathematical models of scientific phenomena. Evidence: Two homework assignments, plus personalized modeling assignments as part of inquiries 2 and 4.

9. Objective: Students can apply scientific arguments in matters of social importance. Evidence: Student presentations of open questions.

10. Objective: Students can write scientific papers. Evidence: Four written inquiries, with inquiries 2 and 4 involving at least two drafts.

11. Objective: Students can review scientific papers and presentations. Evidence: Student evaluations of each other, in pairs, report on a research seminar

12. Objective: Students can present scientific work orally. Evidence: In-class oral reports on inquiries 2 and 4.