**BIOL/CHEM 4700 – Research Methods for Secondary Science Instruction**
**Course Syllabus Fall 2017**

**M/W 5:00 – 6:50 p.m.** **Life Sciences A111**

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**Office Hours: Wednesdays 2:30 – 4:00, Thursdays 11:00 – 12:30, or by appointment**

**Course Description:**
Techniques used to solve and address scientific inquiry. Design of experiments. Use of statistics to interpret experimental results and measure sampling errors. Ethical treatment of human subjects. Laboratory safety. Mathematical modeling of scientific phenomena. Oral and written presentation of scientific work.

**Prerequisites:**
16 hours of biology, chemistry, or physics, depending on major; completion of freshman and sophomore science courses required for certification and consent of department. EDSE 3500 and EDSE 4000 are *highly* recommended.

**Required Course Materials:**
Collins, J.W. (2010). *Texas Safety Standards: Kindergarten through Grade 12, A Guide to Laws, Rules, Regulations, and Safety Procedures for Classroom, Laboratory, and Field Investigations*, 4th Ed. Charles. A Dana Center: Austin, TX.

Sherman, K.M. (2015) *Research Methods: From Research to Practice* (course packet)

The course packet written by Dr. Sherman can be purchased at Eagle Images Copy Center in the Union. Only one copy will be allowed.

**Instructional Emphasis**

***Research Methods for Secondary Science Instruction*** is a two-pronged course that is primarily laboratory-based. This course is steeped in inquiry through research and practical teaching techniques that require the student to take on three different roles throughout the course: scientist, science teacher, and science student. Technology that is used in laboratory situations, both in research and in secondary schools, is used throughout the course. Safety is of utmost importance to a scientist and a science teacher, therefore, much time is spent learning safe practices for inside and outside the science laboratory.

Research Methods students design experiments to answer scientific questions and to reduce systematic and random errors. They incorporate relevant statistics to interpret experimental results and deal with sampling errors. They present their scientific research orally and in writing. Writing is a significant component of the course, and the written reports students produce are evaluated as examples of scientific writing.

Research Methods students also develop relevant laboratory management skills, technology expertise, and classroom management techniques that are needed in the secondary science classroom. The emphasis is on inquiry techniques and science process skills that are used to develop effective habits of mind from a scientific and consumer perspective and that are used to develop 21st century skills in secondary students. State standards are also emphasized, particularly the TEKS and CCRS.

**Course Objectives, State and National Standards:**

| **OBJECTIVES**:<br><br>*Upon completion of this course, students will be able to…* | **Texas PPR EC-12 Competencies:** | **Texas Science 7-12 Competencies:** | **NSTA Standards (2012) for Science Teacher Preparation** |
|---|---|---|---|
| 1. Pose scientific questions and create experiments to answer these questions | 4E | 2A, B, C, 46H | 1A, 6A |
| 2. Find, read, and critique research articles in a field of scientific study | 9B, 9C, 13B | 2D, 2E, 3D, 46D | 1A, 6A |
| 3. Design experiments to reduce systematic and random errors and provide for proper data analysis | 9G | 2D, 3E, 46H, 1G, 1H | 1A, 6A |

| | | | |
|---|---|---|---|
| 4. Implement current technology using probes and computers to gather and analyze data | 3A<br>9A, 9B, 9H | 1F, 46H | 1B |
| 5. Use statistics to interpret results of experiments. | 9D | 1E, 1F, 1G, 46H | 1A, 6A |
| 6. Draw conclusions that answer posed research questions based on careful analysis of collected data and without bias | | 2D, 2E, 46H | 1A, 6A |
| 7. Practice laboratory safety, understand how and why chemical storage in the secondary environments works, state the purpose of and correctly use safety tools in a laboratory setting | 5F, 5G | 1A-D | 4A, B, C |
| 8. Explain why safety is crucial in all laboratory investigation settings | 5F, 5G | 1A, 1B | 4A, B, C |
| 9. Explain the legal and ethical responsibilities of science teachers | 5F, 5G, 13A, 13B, 13C | 1A, 1B, 3D | 4A, B, C |
| 10. Design a safe, functional, and efficient science laboratory. | 3A, 6A, 6C, 6E, 6H-J, 7C, 8A, C, D | 1A-D, 46C, 46F, 46G | 3B, 3D<br>4A, B, C |
| 11. Use a variety of science instructional strategies such as lab activities, demonstrations, modeling, and explanation, to accurately teach scientific concepts, principles, and skills | 3E, 3G, 7C, 7D, 8A, 8C | 46C, 46D, 46F, 46G, 46I | 2A, 2B |
| 12. Write and review scientific papers | 7D, 9E, 10D, 13B | 1E, 2D, 2E, 3D | 1A, 6A |
| 13. Give oral presentations of scientific research | 7D, 9E | 1E, 2D, 2E, 3D | 1A, 6A |

Note: Other Texas PPR competencies that apply in this course associated with Domain IV (fulfilling professional roles and responsibilities) include 12G (work productively with supervisors, mentors, and other colleagues), 12H (understands and uses professional development resources), and 12I (engages in reflection and self-assessment). These standards are common to the courses in the Teach North Texas program.

**Grading:**

| Assignment Category | Percentage of Overall Grade |
|---|---|
| Reading and Statistics Assignments, Reflection Discussions | 10 |
| Safety Certification | 10 |
| Teaching Activities (Canned Lab, Explain My Content, Demonstration Write Up) | 30 |
| Research Project Work | 15 |
| Research Presentations | 10 |
| Rough Draft of Research Paper | 5 |
| Final Draft of Research Paper | 20 |
| Attendance (*Overall grade lowered based on attendance policy below*) | 0 |

***Things that can seriously impact grades and are often over-looked: absences, class behavior, inappropriate use of technology, tardiness, poor participation, missing assignment deadlines, neglecting small assignments.***

**Grading Scale (Percentage of total points earned)**

90 – 100% = A
80 – 89 %= B
70 – 79% = C
60 – 69% = D
0 – 59% = F

**Attendance**

Attendance and punctuality are expected in this course. Daily roll will be taken and you will be responsible for signing the attendance sheet each class period. Tardies and absences will count toward final grade reduction. **Three tardies = 1 absence; 3 absences = 1 letter grade lowered; 4 absences = 2 letter grades lowered; 5 absences = 3 letter grades lowered; 6 or more absences = failure in the class.**

*UNT endeavors to offer students a high-quality education and to provide a supportive environment to help you learn and grow. As faculty members, we are committed to helping you be successful as a student.* ***Here's how to succeed at UNT: (1) Show up; (2) Find support; (3) Get advised; (4) Be prepared; (5) Get involved; and (6) Stay focused.*** *You are encouraged to access the following website: https://success.unt.edu. The site contains multiple student resource links and short videos with student messages.*

**Course Requirements and Expectations**

- Much of what is done in class requires work to be done by you beforehand, especially when discussing different aspects of your research project. It is your responsibility to be fully prepared with all required materials ready to participate in the activities as outlined below. Failure to be fully prepared with all required materials will result in an unexcused absence for you, since you will not be able to participate in class.
- Some course topics will be covered only in class. You must be present to receive credit for these activities.
- Drafts of all writing assignments (components of your final research paper) will be graded and feedback provided based on the Research Paper Rubric. All draft write-ups will receive extensive notation from your instructor. Final drafts will have fewer (if any) comments.
- The research project must be closely related to your major.
- Development of instructional materials in the course is expected and such materials will be shared with classmates in a spirit of collegiality.
- Research Methods is a substantial writing course. Therefore, your writing assignments will be evaluated both on CONTENT and QUALITY of written expression. Conventional use of English language and conventions of scientific writing will be followed. There are no formal examinations. It is typical for your final inquiry paper to run about 15 to 20 tightly edited pages.
- This course is lab-intensive. **When you are provided work time for your research project, you should spend the time on the research project. There is always writing to revise, data to analyze, or experimentation to do. NO OTHER CLASS' WORK IS PERMITTED DURING CLASS TIME.**

**Assignments**

- All assignments are submitted on BlackBoard Learn.
- All assignments are due by midnight of the day the assignment is due. Midnight is defined as being between 11:59 p.m. and 12:00 a.m.
- **No late assignments will be accepted.**
- If you have to miss an in-class assignment due to unforeseen circumstances, let Dr. Sherman know ahead of time. If you let the instructor know in advance, you will be allowed to make the assignment up. Failure to attend and communicate will result in an automatic zero for the assignment.

**Course Schedule** (Tentative)

| Week of: | Topics |
|---|---|
| August 28 | Safety, Research Design |
| September 4 | The Literature Search |
| September 11 | Demonstrations, Proposals |
| September 18 | Proposal Presentations, Demonstration Show, Experimental Design |
| September 25 | Modeling in Science, Experimental Design, Canned Labs |
| October 2 | Canned Labs, Experimental Work |
| October 9 | Canned Labs, Experimental Work |
| October 16 | Teaching Dimensional Analysis, Statistical Analysis, Experimental Work |
| October 22 | Mid-Point Presentations, Statistical Analysis, Teaching and Assessing Science Content |
| October 30 | Experimental Work, Statistical Analysis, Teaching Science Content |
| November 6 | Experimental Work, Statistical Analysis, Teaching Science Content |
| November 13 | Experimental Work, Teaching Science Content |
| November 20 | Data Analysis, Conclusions in Scientific Research |
| November 27 | Writing the Paper, Communication of Research |
| December 4 | Peer Review, Writing the Paper |
| December 11 | Finals |

**Academic Dishonesty**

Students caught cheating or plagiarizing will receive a "0" for that particular assignment or exam [or specify alternative sanction, such as course failure]. Additionally, the incident will be reported to the Dean of Students, who may impose further penalty. According to the UNT catalog, the term "cheating" includes, but is not limited to: a. use of any unauthorized assistance in taking

quizzes, tests, or examinations; b. dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments; c. the acquisition, without permission, of tests or other academic material belonging to a faculty or staff member of the university; d. dual submission of a paper or project, or resubmission of a paper or project to a different class without express permission from the instructor(s); or e. any other act designed to give a student an unfair advantage. The term "plagiarism" includes, but is not limited to: a. the knowing or negligent use by paraphrase or direct quotation of the published or unpublished work of another person without full and clear acknowledgment; and b. the knowing or negligent unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials.

**Acceptable Student Behavior**

Student behavior that interferes with an instructor's ability to conduct a class or other students' opportunity to learn is unacceptable and disruptive and will not be tolerated in any instructional forum at UNT. Students engaging in unacceptable behavior will be directed to leave the classroom and the instructor may refer the student to the Dean of Students to consider whether the student's conduct violated the Code of Student Conduct. The university's expectations for student conduct apply to all instructional forums, including university and electronic classroom, labs, discussion groups, field trips, etc. The Code of Student Conduct can be found at http://deanofstudents.unt.edu . Persistent misbehavior of any kind will result in serious consideration for removal from the TNT program by a committee composed of the instructor, a director of the program, the program advisor, and another TNT faculty member.

**Course Safety Statement**

Students in BIOL/CHEM/PHYS 4700 are required to use proper safety procedures and guidelines. While working in laboratory sessions, students are expected and required to identify and use property safety guidelines in all activities requiring lifting, climbing, walking on slippery surfaces, using equipment and tools, handling chemical solutions and hot and cold products. Failure to follow safety protocols is considered unacceptable student behavior, and appropriate consequences may be applied including verbal warnings, removal from lab, and/or referral to Dean of Students. Persistent refusal to follow safety protocols could result in removal from the TNT program as described above.
Students should be aware that the University of North Texas is not liable for injuries incurred while students are participating in class activities. All students are encouraged to secure adequate insurance coverage in the event of accidental injury. Students who do not have insurance coverage should consider obtaining Student Health Insurance for this insurance program. Brochures for this insurance are available in the UNT Health and Wellness Center on campus. Students who are injured during class activities may seek medical attention at the UNT Health and Wellness Center at rates that are reduced compared to other medical facilities. If you have an insurance plan other than Student Health Insurance at UNT, please be sure that your plan covers treatment at this facility. If you choose not to go to the UNT Health and Wellness Center, you may be transported to an emergency room at a local hospital. You are responsible for expenses incurred there.

**Americans With Disabilities Act**:

*The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking reasonable accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with a reasonable accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request reasonable accommodations at any time, however, ODA notices of reasonable accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of reasonable accommodation for every semester and must meet with each faculty member prior to implementation in each class. Students are strongly encouraged to deliver letters of reasonable accommodation during faculty office hours or by appointment. Faculty members have the authority to ask students to discuss such letters during their designated office hours to protect the privacy of the student. For additional information, see the Office of Disability Accommodation website at http://www.unt.edu/oda. You may also contact them by phone at 940.565.4323.*

***SPOT (Student Perceptions of Teaching)**

Student feedback is important and an essential part of participation of this course. The Student Perceptions of Teaching (SPOT) is a requirement for all organized classes at UNT. This short survey will be made available towards the end of the semester to provide you with an opportunity to evaluate how this course is taught.

***This course syllabus is intended to be a guide and may be amended at any time.***