

**BIOL/CHEM/PHYS 4700 – Research Methods for Secondary Science Instruction
Course Syllabus Spring 2018**

M/W 5:00 – 6:50 p.m.

Life Sciences A111

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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: | Texas PPR EC-12 Competencies: | Texas Science 7-12 Competencies: | NSTA Standards (2012) for Science Teacher Preparation |
|---|--------------------------------------|---|--|
| <i>Upon completion of this course, students will be able to...</i> | | | |
| 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 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 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 (<i>Overall grade lowered based on attendance policy below</i>) | 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 |
|-------------|---|
| January 16 | Safety, Nature of Research |
| January 22 | Research Design, The Literature Search |
| January 29 | Demonstrations, Proposals |
| February 5 | Demonstration Show, Experimental Design, Modeling in Science |
| February 12 | Canned Labs, Texas CCRS |
| February 19 | Canned Labs, Experimental Work |
| February 26 | Canned Labs, Experimental Work |
| March 5 | Teaching Dimensional Analysis, Statistical Analysis, Experimental Work |
| March 19 | Mid-Point Presentations, Statistical Analysis, Teaching and Assessing Science Content |
| March 26 | Experimental Work, Statistical Analysis, Teaching Science Content |
| April 2 | Experimental Work, Statistical Analysis, Teaching Science Content |
| April 9 | Experimental Work, Teaching Science Content, Data Analysis |
| April 16 | Teaching Science Content, Writing the Paper |
| April 23 | Conclusions in Scientific Research, Communication of Research |
| April 30 | Peer and Instructor Review of Rough Draft of Research Paper |
| May 8 | 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](tel: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.

Course Overview – (Subject to change; watch BlackBoard for announcements.)

| Class | Overview of Activities | Assignments |
|---|--|---|
| January 17 Introduction, Safety, and Research | <ul style="list-style-type: none"> Welcome Back! Introductions. Syllabus – expectations of students for this semester Safety – Flinn course Set up login to course Watch video on safety incident with demo. What could have been done differently? What are our responsibilities as teachers? Students write answers to questions then discuss with table group. Share with whole class. Think-Pair-Share – What is science? What is research? Discuss with class. Instructor writes down response on the board What are your goals for this course? Write 2-3. How will you accomplish this? (broad ideas OK). | <p>1) Reading– Sherman Chapters 1 and 2 – assignment due by midnight on 1/21/18</p> <p>2) Research Project – Identify 3 potential topics for research, write questions for each, and locate one journal article for each potential topic – due 1/21/18.</p> <p>3) Flinn Safety Course- Go to http://labsafety.flinnsci.com/CertificateCourseSelection.aspx?CourseCode=HS. Create a login and get started on the safety course. Due 2/4/18.</p> |
| January 22 Research Design | <ul style="list-style-type: none"> Prepare for Gallery Walk of research ideas Seilman’s research – students read high school research report and evaluate the research in terms of ethics, safety, validity. Evaluate the report in terms of quality of writing and quality of content. What grade would you give this student? How does this apply to you as a researcher? Discuss afterwards Reading Discussion – Sherman Chapters 1 & 2 Gallery Walk: research topics and questions. Students will evaluate 3 sets of topics and questions. Lecture: Designing experiments and writing research proposals Student Individual work: make a decision regarding your research topic and research question. Revise question appropriately and write a hypothesis that answers the question. | <p>1) Reading Sherman Chapters 3 & 4 – due 1/23/18</p> <p>2) Research Project – Find one research article related to your research topic and question, print out a hard copy and bring to class 1/24/18.</p> <p>3) Research Project – Research Proposal due 1/28/18. Bring a hard copy to consultation session on 1/29/18.</p> <p>4) Flinn Safety Course- Go to http://labsafety.flinnsci.com/CertificateCourseSelection.aspx?CourseCode=HS. Create a login and get started on the safety course. Due 2/4/18.</p> |
| January 24 The Literature Review | <ul style="list-style-type: none"> Reading Discussion – Sherman, Ch 3 Science librarian for UNT provides instruction about online databases, scientific journals, and how to use search strings (Boolean) properly – best databases and journal sources for work. Students work through searching examples with librarian Students search for 3 research articles about their topic. Librarian and instructors help students. Instructor discusses other sources – textbooks, personal interviews, lab books, etc. Ties in the literature search to the design of their experiment. Instructor discusses how to read and critique research articles. Students complete lit review question sheet for article brought to class. This is beginning of annotated bibliography and literature review | <p>1) Reading Assignment: “Fifteen Simple Discrepant Events That Teach Science Principles and Concepts” E.L.Wright – due 1/28/17.</p> <p>2) Research Project – Research Proposal due 1/28/18. Bring a hard copy to consultation session on 1/29/18.</p> <p>3) Flinn Safety Course – due 2/4/18. (Be sure that you are logged into the course as you work!)</p> |
| January 29 Demonstrations Proposal Consultations | <ul style="list-style-type: none"> Reading Discussion: 15 Discrepant Events Instructor demo show of 2-3 of their favorite demos they do when teaching content classes Debrief of show – students describe the key characteristics of the demos and what the instructor did (big picture ideas) Instructor explains requirements for demonstration write up and demo show Proposal consultations – divided up by major; largest major (Biology) divided up so Biology instructor not overwhelmed Students select a demonstration that illustrates an important concept/principle from Biology or Chemistry. Students figure out the appropriate content standard, how to do this demonstration, and the materials needed. | <p>1) Research Project – Prepare proposal presentation for class on 1/31/18</p> <p>2) Flinn Safety Certification Course -- finish all units and their assessments. Submit copy of certificate(s) to Assignment Portal by 2/4/18.</p> <p>3) Demo Presentation Write-up due 2/4/18.</p> |

| Class | Overview of Activities | Assignments |
|--|---|--|
| January 31 Proposal Presentations Experimental Design – Part 1 | <ul style="list-style-type: none"> • Research proposal presentations – individual presentations (2-3 minutes long, max) followed by 2 minutes of Q&A for each • Think-pair-share: What constitutes a good experimental design? • Discussion about experimental design: controls and variables, independent vs. dependent variable; null and alternate hypotheses; what data/ measurements/scale are appropriate for quantitative research; planning the experimental process • Students define their independent and dependent variables to answer their research question, identify controls for experiment, write null and alternate hypotheses, determine the data and measurements for their research, and sketch out a plan for experiment (done after each section of the discussion) | <ol style="list-style-type: none"> 1) Flinn Safety Certification Course -- finish all units and their assessments. Submit copy of certificates to Assignment Portal by 2/4/18. 2) Research Project – Write up experimental design – due 2/6/18. Bring hard copy of experimental design to class on 2/7/18. |
| February 5 Demo Show! Experimental Design – Part 2 | <ul style="list-style-type: none"> • Student demonstration presentations • Reading Discussion of Sherman Chapter 4. • Discussion of establishing validity and reliability of data through experimental design, the importance of attention to details and writing rich, descriptive, repeatable instructions. • Students write and revise/expand experimental procedures and generate list of materials | <ol style="list-style-type: none"> 1) Reading – either: <ul style="list-style-type: none"> ▪ Passmore, et al (2013) for Biology ▪ Mayer, Damelin, Krajcik (2013) for Chemistry ▪ Campbell Neilson, Oh (2013) for Physics due 2/6/18. 2) Demo Presentation Reflection due 2/11/18. 3) Research Project – Write up experimental design – due 2/6/18. Bring hard copy of experimental design to class on 2/7/18. Bring list of materials to complete experiment to class on 2/7/18. |
| February 7 Modeling in the Science Classroom Experimental Design Consultations | <ul style="list-style-type: none"> • Students brainstorm 3 ways to model the concept given – Student pairs given a different science concept from either life science or physical science. Students share what they came up with. • Students work through three different forms of models. Describe the concept demonstrated with this modeling tool. Where can it be used in the corresponding Biology, Chemistry, Physics, Physical Science course? Models include DNA modeling kit, molecular modeling kit, magnetic circles, toy cars and tracks, black box activity, Phet • Students share what they learned about the modeling tools • Reading Discussion – Modeling in Science Teaching – by pairs then whole group • Instructor discusses theory behind modeling in science teaching • What makes this so funny? Students analyze why a picture of water molecules is so funny. • Students revise their list of models from the Engage to better suit the concept. Reflect on what was learned. • Experimental design consultations and materials list discussions • Students work on experimental design and work on literature critique. | <ol style="list-style-type: none"> 1) Reading Texas Safety Standards: Ch 1 & 2 – assignment due by midnight on 2/11/18. 2) Demo Presentation Reflection due 2/11/18. 3) Research Project: Resubmit experimental procedure before 2/13/18. Experiments may <u>not</u> begin until you have received approval from your instructor. |

| Class | Overview of Activities | Assignments |
|---|---|--|
| February 12 Canned Labs Texas CCRS | <ul style="list-style-type: none"> Reading Discussion: TX Safety Standards Ch 1, 2 What are teacher's responsibility when planning and leading lab activities? Generate a list of responsibilities and duties. Discuss. Instructor describes Canned Technology lab assignment/ activities. Q&A follows. Texas College & Career Readiness Standards overview Students sign up for date and lab to do for Canned Technology Lab assignment and begin working on write-up by exploring activity and available materials/probeware Finish experimental design consultations (as needed) | <ol style="list-style-type: none"> Reading Asst: Texas Safety Standards Ch 4 & 6 – due 2/13/18. Canned Lab - Write-Up due 2/18/18. Research Project: Resubmit experimental procedure before 2/13/18. Experiments may <u>not</u> begin until you have received approval from your instructor. |
| February 14 Canned Lab Preparation | <ul style="list-style-type: none"> Reading Discussion: TX Safety Standards Ch 4, 6 Students run through canned lab and note revisions to make so that the activity meets the instructor's criteria. Students prepare materials for canned lab Students prepare materials and equipment for canned lab. Write student instructions and teacher guidelines Students search for materials from list for research project and discuss list with instructor. | <ol style="list-style-type: none"> Canned Lab Write-Up due 2/18/18 Research Project: Literature Analysis & Critique asst. due by 2/25/18. |
| February 19 Canned Labs Research Work | <ul style="list-style-type: none"> Canned lab presentations (3) Students work on literature critique/experimental work | <ol style="list-style-type: none"> Canned Lab – reflection due 3/9/18 and comments on peer reflections due 3/18/18. Research Project – Literature Analysis & Critique asst. due 2/25/18. |
| February 21 Canned Labs Research Work | <ul style="list-style-type: none"> Canned lab presentations (3) Students work on experiment or literature critique/experimental work | <ol style="list-style-type: none"> Canned Lab – reflection due 3/9/18 and comments on peer reflections due 3/18/18. Research Project – Literature Analysis & Critique asst. due 2/25/18. |
| February 26 Canned Labs Research Work | <ul style="list-style-type: none"> Canned lab presentations (3) Students work on experiment or literature critique/experimental work | <ol style="list-style-type: none"> Canned Lab – reflection due 3/9/18 and comments on peer reflections due 3/18/18. Research Project – experimentation and adjustments to experiment/data analysis as needed. Take thorough notes throughout the experiment, as well as photos to include in your paper. |
| February 28 Canned Labs Research Work | <ul style="list-style-type: none"> Canned lab presentations (3) Students work on experiment or literature critique/experimental work | <ol style="list-style-type: none"> Canned Lab – reflection due 3/9/18 and comments on peer reflections due 3/18/18. Research Project – experimentation and adjustments to experiment/data analysis as needed. Take thorough notes throughout the experiment, as well as photos to include in your paper |
| March 5 Teaching Dimensional Analysis Research Work | <ul style="list-style-type: none"> Lesson on teaching metric system and dimensional analysis Students lead class in solving a dimensional analysis word problem Students work on experiment <p><i>Be sure that you have an adequate number of trials and samples in each trial to validate your data.</i></p> | <ol style="list-style-type: none"> Reading Asst. – Sherman Ch 5 & 6 due 3/6/17. Canned Lab – reflection due 3/9/18 and comments on peer reflections due 3/18/18. Research Project – experimentation and adjustments to experiment/data analysis as needed. |

| Class | Overview of Activities | Assignments |
|---|--|---|
| March 7 Canned Labs Statistics 1 Research Work | <ul style="list-style-type: none"> • Canned Lab (1-2) • Reading Discussion of Sherman Chapter 5 • Discussion of distributions of data, measures of central tendency (mean, median, mode), variance, standard deviation, frequency distributions, how to use Excel® to do these statistics, installing Data Analysis pack on Excel • Students work examples in PowerPoint • Students run experiments Or <ul style="list-style-type: none"> • Stats 1 HW, organize data • Discuss expectations for mid-point presentations on 10/23 | <ol style="list-style-type: none"> 1) Canned Lab - reflection due 3/9/18 and comments on peer reflections due 3/18/18. 2) Statistics HW 1 – due 3/18/18. 3) Research Project – experimentation and adjustments to experiment/data analysis as needed. Take thorough notes throughout the experiment, as well as photos to include in your paper. 4) Research Project –Presentation of initial results on March 21, 2018. Be ready to present and answer questions! |
| SPRING BREAK March 12 - 16 | | |
| March 19 Statistics 2 Explaining Your Content | <ul style="list-style-type: none"> • Discuss Statistics 1 HW • For each of the following graphs, what kinds of data sets can be described by each? Teams of 2 get a graph (circle, bar graph/histogram, scatterplot) and write an example of a data set (not actual data values) that could be described by their graph. Teams share results. Discuss • Discussion on graphs, purpose and functions of each type, scatterplots and linear regression, how to do graphs and linear regression in Excel® • Students work examples in PowerPoint • Reflect: What specific strategies were used to teach about graphing? What questions were asked? • Overview of Teaching Your Content Activity • Sign up for dates and topics (from list) | <ol style="list-style-type: none"> 1) Statistics HW 2 – due 3/25/18 2) Research Project – Write up experiment revisions and list of materials needed to replenish/replace what is needed. Bring revisions and list of materials to class on 3/21/18. 3) Explaining Your Content – write up due 4/1/18 |
| March 21 Mid-Point Presentations Experimental Revisions | <ul style="list-style-type: none"> • Research project presentations of initial results • Make revisions to experimental design (as needed) • Run experiments | <ol style="list-style-type: none"> 1) Statistics HW 2 – due 3/25/18 2) Research Project – experimentation and adjustments to experiment/data analysis as needed. 3) Explaining Your Content – write up due 4/1/18. |
| March 26 Research Work Lesson Preparation | <ul style="list-style-type: none"> • Go over Statistics 2 HW Work day! <ul style="list-style-type: none"> • Work on notes, handouts, and guided practice materials for content/skill lesson OR <ul style="list-style-type: none"> • Experimental work on research project | <ol style="list-style-type: none"> 1) Explaining Your Content – write up due 4/1/18. |
| March 28 Statistics 3 Research Work | <ul style="list-style-type: none"> • Show a normal distribution. Students describe its properties and discuss with a neighbor. • Discussion on probability and the normal distribution. Characteristics of a normal distribution. Skewed distributions. Standard Error • Students work examples in PowerPoint • Reflection: How can I guarantee a statistically significant amount of data gathered from my research? What measurements that I make require the mean, standard deviation, and standard error to establish precision of my measurements? (Sherman Ch 5, p 29 #2 & 3) | <ol style="list-style-type: none"> 1) Explaining Your Content – write up due 4/1/18. |

| Class | Overview of Activities | Assignments |
|--|--|---|
| April 2 Explaining Your Content Research Work | <ul style="list-style-type: none"> • Student micro-teaching of content/skills (Explain 2 portion of 5E model) - 3 • Peer evaluation of content knowledge and teaching effectiveness • What did I learn today about Biology and Physics content that I did not know before? • Experimental work on research project | 1) Explaining Your Content – reflection due 4/22/18. <i>Be sure that you have an adequate number of trials and samples in each trial to validate your data.</i> |
| April 4 Statistics 4 Research Work | <ul style="list-style-type: none"> • Reading Discussion of Sherman Chapter 6 • Discussion on 95% confidence intervals, t-test calculations, using Excel to do t-test calculations, drawing conclusions based on statistical test of null hypothesis, alternate statistical tests depending on data set and purpose of research • Students work examples in PowerPoint • Experimental work on research project Or <ul style="list-style-type: none"> • Statistics HW 3 | 1) Statistics HW 3 due 4/8/18. <i>Be sure that you have an adequate number of trials and samples in each trial to validate your data.</i> |
| April 9 Explaining Your Content Research Work | <ul style="list-style-type: none"> • Discuss Statistics HW 3 • Student micro-teaching of content/skills (Explain 2 portion of 5E model) - 3 • Peer evaluation of content knowledge and teaching effectiveness • What did I learn today about Biology and Chemistry content that I did not know before? • Experimental work on research project | 1) Explaining Your Content – reflection due 4/22/18. <i>Be sure that you have an adequate number of trials and samples in each trial to validate your data.</i> |
| April 11 Explaining Your Content Data Analysis | <ul style="list-style-type: none"> • Student micro-teaching of content/skills (Explain 2 portion of 5E model) - 3 • Peer evaluation of content knowledge and teaching effectiveness • What did I learn today about Biology and Chemistry content that I did not know before? • Ask question: What kinds of data have you gathered? What kinds of graphs can you draw to illustrate the patterns and trends in the data? Discuss with table. • Instructor summarizes requirements for statistics, graphs, charts, and the analysis section of the paper – section for data analysis in research project rubric used as guide – emphasis on reliability of data, validity of data, error analysis | 1) Explaining Your Content – reflection due 4/22/18. 2) Research Project – Complete tables, graphs, and statistics for research project and complete data analysis section of research paper – due 4/15/18. Bring hard copy to consultation session on 4/16/18. <i>Be sure that you have an adequate number of trials and samples in each trial to validate your data</i> |
| April 16 Explaining Your Content Data Analysis Consultations | <ul style="list-style-type: none"> • Student micro-teaching of content/skills (Explain 2 portion of 5E model) - 2 • Peer evaluation of content knowledge and teaching effectiveness • What did I learn today about Biology and Chemistry content that I did not know before? • What goes into a Conclusion? • Data Analysis consultation time • Rerun experiments (as needed) • Revise analysis of data – both statistically and written. | 1) Reading Assignment: Sherman Chapter 7 & 8– due 4/17/18 2) Explaining Your Content – reflection due 4/22/18. 3) Research Project – make additions and revisions to data analysis section. Complete all statistical analyses of data. Bring all borrowed materials back to class by 4/23. |

| Class | Overview of Activities | Assignments |
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| <p>April 18</p> <p>Writing The Paper</p> | <ul style="list-style-type: none"> • What are the major components of any research paper? What are the characteristics of a good research paper? Students make lists, discuss with their table then, discuss with whole class. Instructor compiles lists • Reading Discussion of Sherman Chapter 7 • Instructor discusses what goes into each section of the research paper (Introduction, Literature Review, Experimental Methods, Results, Data Analysis, Conclusions, References, Abstract) and the order of writing the paper. Instructor reinforces that most of the paper is already written during the semester, but needs put together with good transitions. • Write conclusions and rough draft of research paper | <p>1) Research Project – Conclusions due 4/22/18. Bring a hard copy to class on 4/23/18.</p> <p>Bring all borrowed materials back to class by 4/23.</p> |
| <p>April 23</p> <p>Conclusion Consultations</p> | <ul style="list-style-type: none"> • Conclusion consultation time • Work on rough draft of paper | <p>1) Research Project – Rough draft of research paper due 4/29/18. Bring a hard copy to class on 4/30/18.</p> |
| <p>April 25</p> <p>Communication of Research</p> | <ul style="list-style-type: none"> • Students discuss with a partner “What makes a good lab report?” Lists generated regarding quality of content and quality of writing • Reading discussion of Sherman Chapter 8 – in pairs then with whole class • Students with a partner determine the following: What makes a good oral presentation? What makes a good speaker? What makes a good audience? • Students and instructor discuss oral presentation lists generated. Instructor discusses rubric for oral presentation. • Students with a different partner determine the following: What constitutes a good visual aid? What makes a visual aid poor quality? These are discussed in terms of content, organization, and attractiveness. • Students and instructor discuss visual aid lists generated. | <p>1) Research Project – Rough draft of research paper due 4/29/18. Bring a hard copy to class on 4/30/18.</p> |
| <p>April 30</p> <p>Rough Draft Consultations</p> <p>Inventory</p> | <ul style="list-style-type: none"> • Instructors consult with students about their rough draft – divided by major, largest major (Biology) divided among instructors so all students have consultation time. • Students make revisions to rough draft based on instructor feedback after consultations and/or while waiting. • Lab Inventory – students inventory and organize contents of lab noting items we need more of • What do we need next semester? | <p>1) Research Project – Complete and update rough draft based on instructor review and consultation discussion. Bring hard copy to class on 5/2/18 for peer review.</p> |
| <p>May 2</p> <p>Peer Review</p> | <ul style="list-style-type: none"> • SPOT and Course Evaluations • Peer review of research papers - Papers reviewed for quality of content then quality of mechanics of writing. • Reminders about expectations for oral presentations | <p>1) Research Project – Presentations on 5/7/17 during normal class time.</p> <p>2) Research Project – Final draft of paper due 5/9/18.</p> |
| <p>May 7</p> <p>Final Presentations</p> | <ul style="list-style-type: none"> • Research Project presentations | <p>Final draft of paper due by midnight on 5/9/17.</p> |