2015

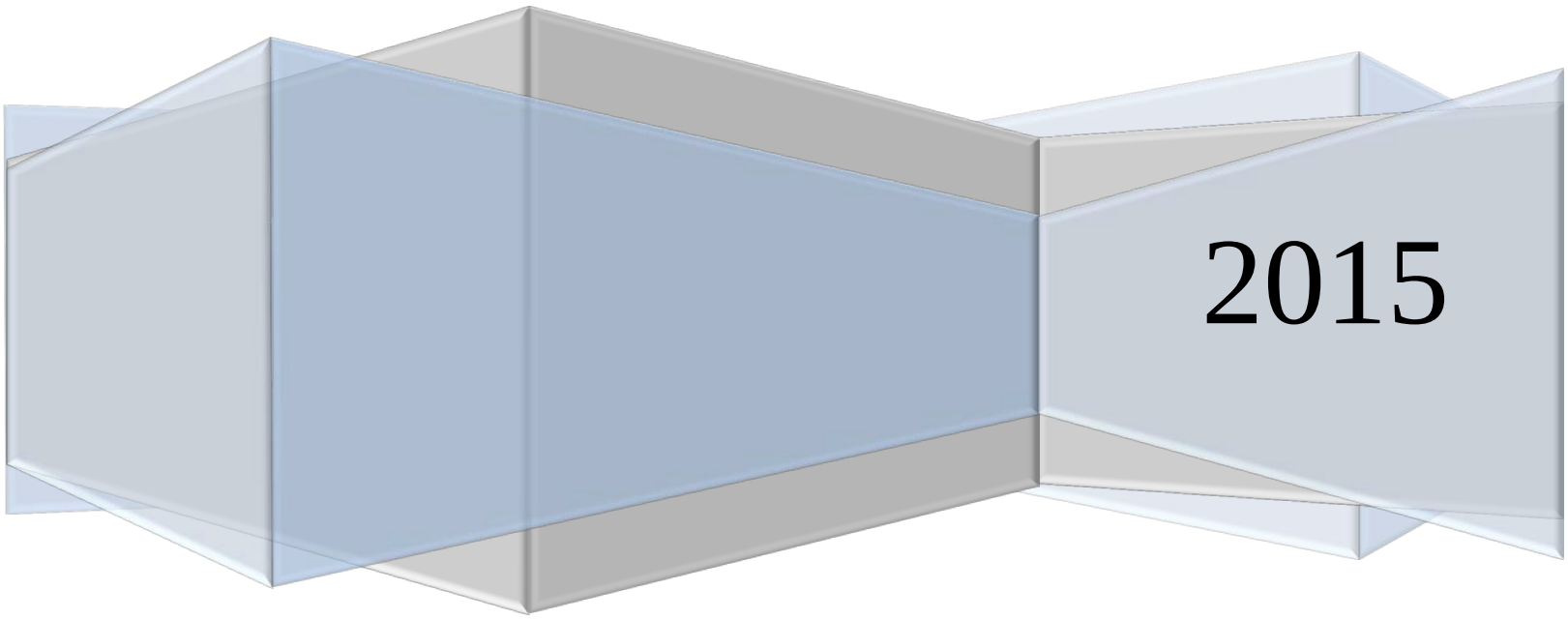
AGRO/HORT403/803: Scientific Writing and Communication—A Peer Review of Teaching Project Inquiry Portfolio

Brian Waters
University of Nebraska-Lincoln, bwaters2@unl.edu

AGRO/HORT 403/803: Scientific Writing and Communication

A Peer Review of Teaching Project Inquiry Portfolio

Brian Waters
Department of Agronomy and Horticulture
University of Nebraska
Lincoln, NE 68583-0915
bwaters2@unl.edu



Abstract

Scientific writing is a skill that is useful for science students, since many of them will write about their research in theses, dissertations or journal articles. However, many students have not been trained in scientific writing, and the task seems insurmountable to some, who can develop a “fear of writing” that prevents them from finishing their program or manuscript. To effectively teach scientific writing, the instructor should devote the most effort to the most effective learning activities. Thus, this inquiry portfolio addresses two Research Questions: 1) “What is the most effective activity in my course for student learning?”, and 2) “Does this course increase student confidence in scientific writing?” First-day and last-day quizzes and surveys were used to collect data about student knowledge and opinions of class activity effectiveness, and student confidence levels for scientific writing tasks. This data indicated a strong improvement in scientific writing knowledge and confidence, and showed that the writing process itself, and the revising process using instructor and peer feedback, were the two most effective learning activities.

Table of Contents

INTRODUCTION

Background

My course is called “Scientific Writing and Communication” (see **Appendix 1** for syllabus). This course is an ACE10 course in which students “Generate a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation, presentation, and reflection”. It is also a capstone course for two undergraduate majors in the Agronomy and Horticulture department, Plant Biology and Horticulture (Plant Science option). The course is also open to graduate students also. Over the two semesters of teaching this class (Table 1), I have had eight undergraduate and 14 graduate students, from eight majors, with an overall equal number of male and female students.

Student Demographics:	2014	2015	Total
Undergraduate students	5	3	8
Graduate students	5	9	14
	2014	2015	Total
Male	4	7	11
Female	6	5	11
Majors:	2014	2015	Total
Horticulture	3		4
Plant Biology	2	2	4
Biology	1		1
Agronomy	2	6	8
Food Science	1		1
Biological Systems Engineering	1	1	2
Agricultural and Biological Systems Engineering		2	2
Plant Pathology		1	1

Table 1. Student demographics in AGRO/HORT 403/803, Scientific Writing and Communication, in Spring Semester 2014 and 2015.

The course has three phases. In phase 1, students learn to read and critically evaluate scientific literature in Plant Biology. In phase 2, which is the bulk of the course, students write a research paper based on their own original research and peer-review research papers of fellow students. In phase 3, students present their research in a poster format. Specific learning objectives are:

1. Identify and recommend appropriate sources of scientific research information (e.g. peer-reviewed journals)
2. Appraise and critique the methodology, results, and interpretations in scientific writing
3. Be able to clearly and simply state the hypothesis and/or research goal(s) and specific objectives of their project
4. Assemble results of experiments, compose figures and/or tables, organize manuscript in standard scientific format, and provide interpretations in the context of existing knowledge
5. Prepare a research poster and deliver a poster presentation for a general scientific audience

Lessons from the first course offering

In most aspects, the first time I taught this course it was a success. No major problems arose, and the students improved in both scientific writing knowledge, as determined by a pre-course test and post-course test, and in scientific writing skill, as determined by error frequency changes between first drafts and final versions. My survey of students indicated overall satisfaction with the course and helped me learn about several specific aspects. Despite this success, I was still not exactly sure which class activities were most effective for student learning, information that is crucial for setting the best class schedule.

I also learned from a current graduate student about several former graduate students in our department who **dropped out of the program rather than write a thesis**, because the writing process was too intimidating. This lack of confidence/intimidation factor can be contagious. So, I decided to use my first- and last-day surveys to test whether student confidence in writing ability increased after this course.

Changes to the course and surveys that I made were:

- more examples about sentence-level scientific writing
- developed a new "reader/writer" form to help structure scientific papers
- refined the pre-test and post-test questions
- surveyed student goals and confidence levels at the beginning and end of class

Inquiry Research Questions

Research Question 1: What is the most effective activity in my course for student learning?

Research Question 2: Does this course increase student confidence in scientific writing?

Course Activities

I summarized the course in 12 class activities. The first phase of the course contains three of the class activities: **1)** reading journal articles ("example papers") and **2)** discussing these journal articles as a class. As part of the study of these papers, the students **3)** fill out a "reader/writer" form, which can also be used later, as the students write their drafts. As we move into the second phase of the class, students **4)** search scientific literature databases for papers related to their work and read these papers. It is during this time I begin the next activity, **5)** class lectures with PowerPoints that the students have access to for later use. They are also assigned **6)** textbook reading as we go through the chapters, and are provided with **7)** links and extra articles on Blackboard.

After I give my lecture on each section of a scientific article, the students **8)** write their drafts. These are turned in to me and to three other students, who **9)** read the peers work and **10)** edit/review the writing and make comments and suggestions. The students then **11)** revise their drafts using comments from me and from their peers. After the first final draft, the students are then asked to **12)** do a reverse outline of their paper to see if structural changes would improve it.

Methods

All students signed informed consent statements allowing me to collect data.

To test for improvement in knowledge of scientific writing, I had the students take a 25-question quiz on the first day of class (pre-test) to establish their baseline knowledge of scientific writing principles (**Appendix 2**). On the last day of class, they take the same quiz again (post-test).

I gathered data was from two surveys. The first day of class survey (**Appendix 3**) included five questions to gauge the preparedness of the students. I then asked three questions about their confidence levels for a) reading and analyzing scientific literature, b) finding and citing appropriate literature, and c) writing a scientific manuscript. I also asked students to list three goals for themselves for the class, and asked which specific aspects of scientific writing they felt like they needed to improve.

On the final day of class, I gave another survey (**Appendix 4**). The first part presented a series of statements about the course in general and about usefulness of specific parts of the course. The students indicated their agreement or disagreement with these statements on a 5-point scale from "strongly disagree" to "strongly agree". In a separate section, they were also asked to rank the effectiveness of the 12 class activities outlined above and explain their top two choices. Another section of the survey repeated the confidence questions from the first day survey. Another section asked them to rate their improvement in specific areas taken from the goals and improvement target areas from the first day survey.

Results

Pre- and post-test

For the Spring 2015 semester, the mean scores on the post-test increased from 13.1 to 17.5, a statistically significant increase of 34%, or an increase of 36.8% as averaged by student (Table 2). There was no special preparation for the post-test, and the students did not have access to the questions between tests, so I am confident that the improvement represents actual learning of scientific writing principles.

	Pre-Quiz score	Post-Quiz Score	%change
	15	17	13.3
	12	14	16.7
	17	20	17.6
	19	23	21.1
	14	17	21.4
	13	17	30.8
	12	16	33.3
	12	17	41.7
	11	16	45.5
	12	18	50.0
	12	21	75.0
	8	14	75.0
Mean	**13.1**	**17.5**	**36.8**
SD	2.9	2.7	21.4
T-test		0.000789	

Table 2. Pre- and post-test results.

Activities rankings

The results of the first part of this survey indicated that the components (reading and discussing example papers, peer reviewing of drafts, instructor reviewing of drafts) of the course I designed were well-received and thought to be useful (**Fig. 1**). Additionally, I was able to address some of my concerns presented earlier in this portfolio. The pace of the course seemed to be about right, since agreement/disagreement with the statements that it was "too fast" or "too slow" were generally consistent. The order of topics

was confirmed to be correct. All students agreed or strongly agreed that the course was useful to their overall education, they would recommend the course to their peers, and their ability to read and evaluate scientific papers had improved. Important to the ACE10 status of the course, all students agreed or strongly agreed that their knowledge of scientific writing and their skill in scientific writing had improved.

Please indicate how strongly you agree with the following statements:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The instructor reviews/edits of my drafts were helpful				2	10
After this course, my knowledge of scientific writing has improved				4	8
This course has been useful to my overall education				5	7
After this course my ability to read and evaluate scientific papers has improved				5	7
After this course, my skill in scientific writing has improved				6	6
Reading the four example papers was helpful				8	4
The order of the topics should not be changed			1	4	7
The peer reviews/edits of my drafts were helpful			1	4	7
I would recommend this course to my peers			1	4	7
Editing my peers' writing helped me learn about scientific writing			1	5	6
Discussing the four example papers was helpful		2		4	6
Using the reader/writer form improved my ability to read and understand scientific papers.			2	4	5
The textbook for this class was useful		1	3	5	3
Using the reader/writer form improved my ability to organize and write my scientific paper.			3	5	3
The in-class writing time was useful			4	4	4
Reading about research of my peers helped me learn about plant science	1	1	4	2	4
More time on example papers' structure would have been helpful		6	3	2	1
The in-class writing time encouraged me to wait until class time to begin writing	4	5	3		
The pace of the course was too fast	5	5	2		
The pace of the course was too slow	3	9			

Fig. 1. General course information survey results.

The usefulness of some of the class activities was indicated in Fig. 1, however, this information does not explain which activities are the *most* effective. The aggregate results of the student rankings are shown in **Fig. 2**. It was clear that two activities were the most highly effective: “Revising my drafts using peer/instructor comments” was ranked first, and “Writing my drafts” was ranked second. Somewhat surprisingly, “Class lectures and PowerPoints” was ranked third. This is in contrast with results from 2014 (**Fig. 3**), in which “Class lectures” was ranked 9th.

Please rank the effectiveness of each part of the course in terms of your learning, with "1" being the most effective, "2" being the second most effective, etc., down to "12" being the least effective.																
Activity	Overall Rank	UG	UG	UG	G	G	G	G	G	G	G	G	G	mean	median	mode
Revising my drafts using peer/instructor comments	1	6	1	1	2	4	1	2	3	8	2	2	1	2.8	2	1
Writing my drafts	2	2	3	3	3	3	5	4	1	5	4	1	2	3.0	3	3
Class lectures and powerpoints	3	5	2	2	1	1	3	1	4	6	1	7	9	3.5	3	1
Searching for and reading papers to cite	4	12	9	6	6	12	4	1	2	1	3	3	11	5.8	5	12
Discussing the four example papers	5	4	5	4	5	2	7	7	5	10	5	12	6	6.0	5	5
Reading the four example papers	6	7	8	5	7	6	6	6	6	4	7	4	8	6.2	6	6
Editing my peers' work	7	1	4	9	8	7	10	9	8	7	8	5	7	6.9	8	8
Textbook reading	8	8	12	12	4	9	2	5	7	9	12	8	4	7.7	8	12
Reading my peers' work	9	3	6	10	9	5	12	8	11	11	9	6	5	7.9	9	6
Using the reader/writer form	10	11	7	8	11	8	9	3	9	12	10	9	3	8.3	9	9
Links and extra articles on Blackboard	11	9	11	11	10	10	8	10	10	2	6	11	12	9.2	10	10
Reverse outlining	12	10	10	7	12	11	11	11	12	5	11	10	10	10.0	11	10

Fig. 2. Effectiveness ranking survey results.

To have a greater sample size, I revised the 2014 class activity categories to match the updated 2015 class activities, and combined the survey results of the 10 students in 2014 with the results from the 12 students in 2015 (Fig. 3).The top two categories in 2015 matched those from 2014. Interestingly, the undergraduate students ranked the mid-range effectiveness class activities differently, potentially reflecting the greater experience in reading and writing for the graduate students.

Class Activity	2014 Overall Ranking	2015 Overall Ranking	Combined Overall Ranking		Combined UG Ranking	Combined Grad Ranking
Writing my drafts	1	2	1		1	1
Revising my drafts using peer/instructor comments	2	1	2		2	2
Discussing the four example papers	3	5	3		3	5
Class lectures and powerpoints	9	3	4		5	4
Reviewing/editing my peers' work	4	7	5		4	7
Searching for and reading papers to cite	5	4	6		7	3
Reading the four example papers	7	6	7		6	6
Reading my peers' work	6	9	8		8	8
Textbook reading	10	8	9		11	9
Using the reader/writer form	N/A	10	10		10	10
Reverse outlining	8	12	11		9	12
Links and extra articles on Blackboard	11	11	12		12	11

Fig. 3. Effectiveness ranking survey results for 2014, 2015, and combined years.

Student Confidence

On the first day of class, students mostly indicated that they were “somewhat” or “moderately" confident in their ability to read and analyze a scientific paper, and also in their confidence regarding finding and citing appropriate literature (**Fig. 4**). The confidence ratings were even lower for ability to write a scientific paper, with most marking “somewhat” or “not at all”. However, on the last day of class, most students marked “quite” or “very” confident for all three tasks, indicating a substantial improvement in confidence. Numerically, the percentage of

students in the lower confidence categories decreased by XX% to YY %, while the “very” confident category went from being selected by 0% of students to being selected by 25% for “read and analyze” and “write”, and 50% for “find and cite” (**Fig. 5**).

	First day survey					Final survey				
	Not at all	Somewhat	Moderately	Quite	Very	Not at all	Somewhat	Moderately	Quite	Very
How confident are you in your ability to *read and analyze* a scientific paper right now?	1	5	4	2				2	6	4
How confident are you in your ability to *find and cite appropriate literature* related to your manuscript right now?	1	5	4	2		1		1	4	6
How confident are you in your ability to *write* a scientific paper right now?	3	7	2				1	3	4	4

Fig. 4. Results of student confidence survey in Spring 2015.

	Change from first day of class to last day of class				
	Not at all	Somewhat	Moderately	Quite	Very
How confident are you in your ability to *read and analyze* a scientific paper right now?	-8.3	-41.7	-16.7	33.3	33.3
How confident are you in your ability to *find and cite appropriate literature* related to your manuscript right now?	0.0	-41.7	-25.0	16.7	50.0
How confident are you in your ability to *write* a scientific paper right now?	-25.0	-50.0	8.3	33.3	33.3

Fig. 5. Change in percentage of students in each confidence category in Spring 2015.

I also surveyed the students on accomplishment of common goals, based on first day survey results (**Fig. 6**). If the students indicated improvement in these areas, I interpret this as that they will also have increased confidence in their abilities in these areas. All goals had the majority of responses in “Good” or “Great” improvement, with the exception of one. The exception was improvement in “Language/grammar/word use”, which was not surprising, since this course is not designed to address these language fundamentals, and since we did not have specific lessons on these topics.

After this class, please rate your improvement in:	None	Small	Moderate	Good	Great
Scientific writing ability			2	5	5
Clear and logical presentation			2	5	5
Languange/grammar/word use			7	5	
Searching for and citing sources	1		1	5	5
Structuring a scientific paper to "tell a true story"			1	5	6
Understanding the scientific writing and publishing process			1	6	5
Writing an Introduction Section			1	6	5
Writing a Results Section			1	8	3
Writing a Discussion Secion			3	4	5
Making an effective scientific poster			1	6	5

Fig. 6. Results of student goal accomplishment survey in Spring 2015.

Discussion

Effectiveness of class activities

Most of the class activities were surveyed in one way or another, either in the general course survey or in the ranking survey. Five of the 12 activities were in the general course survey and were judged by the students to have been helpful, since 75% or greater of the respondents agreed or strongly agreed with the statements of usefulness (**Fig. 1**). This included usefulness of the reader/writer form for reading the example papers, which was ranked 10th out of the 12 activities (Figs. **2**, **3**). Thus, it is safe to conclude that all activities that were ranked higher than the reader/writer form were considered to be useful by at least 75% of the students. Thus, I do not plan to make any substantial changes to class activities.

The reader/writer from was something I developed and used for the first time this semester. I used it primarily for having the students study the structure of the example papers, that is, for reading. However, I did not take full advantage of using this form for helping the students structure their writing of their own manuscript. In the next class offering, I will use this form more extensively, and I expect that it will be more highly ranked at the end of the next semester.

The survey did not have questions to indicate the usefulness of the lowest two ranked activities, “reverse outlining” and “extra articles and links on Blackboard”. Neither of these activities were done during class time. By the nature of these activities, I would expect that these activities were useful to less than 75% of the students. Reverse outlining helps an author to restructure a manuscript but is not helpful for a manuscript that does not need structural changes. However, it is a useful skill to know, which is why I taught it to the class. The extra articles and links on Blackboard were not required reading, thus probably only a few students took advantage of this resource. In the future I may add some survey questions to gather data about usefulness of the reverse outline, and to see how many students took advantage of the extra materials on Blackboard.

Student confidence

Student confidence in writing a scientific paper, reading and analyzing a scientific paper, and finding and citing appropriate literature all increased substantially (Figs. **4**, **5**). Only one student indicated no improvement, in the area of finding and citing literature. This was an area where students enter the class with a wide range of experience. Some of the graduate students have ample experience with searching the literature databases, while others, especially the undergraduates, have no experience. This diversity in experience makes it challenging to spend enough time for those who need to learn how while not wasting the time of students who are already skilled in this area, or who may have already collected all the necessary papers. I will probably add one additional class period to this topic in the future.

Student achievement of student-defined goals (from the first day survey) was also substantial, with most categories having greater than 80% “good” or “great” improvement (**Fig. 6**). This indicates that student confidence greatly increased for most of these categories. One category

that could use additional class time or emphasis from me is “Writing a discussion section”. This category still had 75% “good” or “great” improvement, but 3 students (25%) indicated only “moderate” improvement, a higher number than for most of the other categories. I will increase my coverage of the Discussion section in the future, and increased use of the reader/writer form should help with writing the Discussion.

Conclusions

My survey results indicate that all the activities that I dedicate class time to are considered to be useful by the vast majority of students. The survey results also indicate that these class activities lead to a substantial overall increase in student confidence. The increased confidence in scientific writing, citing literature, and reading and analyzing literature indicates that students will have less “fear of writing” than if they had not taken this class. I hope that this will translate to higher productivity for the careers of these students. Even more importantly, I hope that this increased student confidence will result in fewer students dropping out of graduate school, either directly for students that have taken my class, or indirectly from contact with students who have taken my class and project confidence in scientific writing, or who can offer advice and encouragement to students with low confidence.

Appendices

Appendix 1: Syllabus

AGRO/HORT 403/803: Scientific Writing and Communication (Capstone)
Spring Semester 2015 University of Nebraska

Instructor: Brian Waters
Office: 377K Plant Sciences Hall
Telephone: 402-472-0153
email: bwaters2@unl.edu
Office hours: Drop in or by appointment

Required materials:
Textbook: Scientific Writing and Communication, Second Edition, by Angelika H. Hofmann. Oxford University Press,
ISBN 978-0-19-994756-0
Access to a computer and internet, Word and PowerPoint (or equivalents), access to printer

Course Prerequisites: Senior standing or higher, science major, an ACE1 written communication course, an ACE2 oral communication course, and permission of instructor. Because students will need data for analysis and interpretation, all students must have their own original dataset, or have obtained a dataset from an advisor or other source before permission will be granted.

Course Overview: This course combines science disciplines with English and communications. Students will begin with original data/information and use the scientific theory from previous courses to interpret this data/information to generate knowledge. Through the scientific writing process, students will learn how to communicate the knowledge in a scientific context so that it becomes understanding. This requires both visual presentation in figures and tables as well as explanations through writing and/or oral presentation. This course will focus on developing literature review, writing, and presentation skills to allow students to present understanding to a broad audience. Two primary activities will require synthesis and integration: a) a final research manuscript that contains references and comparison to scientific literature and has gone through revisions and student peer review, and b) a poster presentation of student research.

403/803 Distinction: Students enrolled in 803 will have additional assignments of a) writing a cover letter for submission of their research paper to a peer-reviewed journal, and b) writing a cover letter for a job application.

ACE required material: This course will satisfy ACE Learning Outcome 10: “Generate a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation, presentation, and reflection.” Students have opportunities to acquire the knowledge and skills necessary to achieve the learning outcome by performing literature searches, critiquing published papers, writing and revising drafts of the final

research paper, peer reviewing, and preparing and presenting a research poster. Assignments used to assess achievement of Learning Outcome 10 will include the final research paper and the poster presentation.

Attendance policy: Attendance is required.

Assessment:
10% Research paper critiques - a standard format will be provided for students to critique four example papers
5% Initial outline and reverse outline, citation list assignments
10% Drafts of research paper - drafts will include each section of the IMRaD (Introduction, Methods, Results and Discussion) format paper plus the abstract and title, and a draft of the complete manuscript
40% Final research paper - complete paper, revised based on peer review
10% Peer reviewing - a standard format will be provided for students to constructively critique their peers' writing
15% Project poster - the same research as the written paper will be presented in an alternative format that is widely used at scientific conferences
10% Oral poster presentation - the revised poster will be presented to the class

Grading scale: A: 90-100%, B: 80-89%, C: 70-79%, D: 60-69%, F: <60%

Learning Objectives:
1. Identify and recommend appropriate sources of scientific research information (e.g. journals)
2. Appraise and critique the methodology, results, and interpretations in scientific writing
3. Be able to clearly and simply state research hypotheses and specific objectives, and write results and discussion that address the hypotheses and objectives
4. Assemble results of experiments, compose figures and/or tables, organize manuscript in standard scientific formant, provide interpretations in the context of existing knowledge
5. Prepare a research poster and deliver a poster presentation for a general audience

Catalog description: A course in reading and critiquing, writing, and presenting scientific information. Students use research data to compose a manuscript in standard scientific format, and prepare and present a poster to a general audience. Ethical issues in research and writing will be addressed.

Due dates: see schedule and course Blackboard page

Late assignment policy: for this type of class, it is crucial that all assignments are completed on time. Thus, late assignments will be docked 20% per day.

Academic honesty policy:
Academic honesty is essential to the existence and integrity of an academic institution. Any instances of academic dishonesty will be handled as described in the UNL Student Code of Conduct (http://stuafs.unl.edu/ja/code/).

ADA statement: Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.

Course outline:

I. Scientific writing style and composition (3 weeks)
    a. Reading papers
    b. Critiquing papers
II. Ethics in research and writing (1 week)
    a. Avoiding plagiarism
    b. Ethics in citations
    c. Literature search and referencing
III. First draft of research paper (8 weeks)
    a. Introduction
b. Materials and methods
    c. Results
    d. Discussion
    e. Abstract and Title
IV. Final draft of research paper (2 weeks)
V. Making a research poster (1 week)
VI. Presenting the posters (During final exam)

Peer Review of Teaching Project: This semester, I am participating in the Peer Review Project, a University-wide, on-going program to develop methods for promoting and documenting student learning. This is a year-long process in which participants in the project (professors) put a great deal of thought into the design of a single course. One of the project's goals is to improve student learning, and we cannot accomplish this goal without student input. For the project, I will need to select several students whose work would be included anonymously in my course portfolio as an archive of student performance. These examples are important to show how much and how deeply students are learning. The completed course portfolio will be put on a project website: www.courseportfolio.org so that it can be shared, used, and reviewed by other faculty.

Appendix 2: Pre- and post-course quiz

Name: _____

Spring 2015 Pre-course Quiz AGRO/HORT 403/803

1. The first principle of scientific writing is to write with _____ in mind.
a. peer reviewers
b. the reader
c. the journal
d. the major result

2. Scientific writing should use _____ words.
a. precise
b. simple
c. esoteric
d. both a and b
e. both a and c
f. all of a, b, and c

3. Old, familiar, and short information should be placed at the _____ of a sentence in the _____ position.
a. beginning, topic
b. end, topic
c. beginning, stress
d. end, stress

4. Scientific writing should use the _____ person.
a. first
b. second
c. third
d. passive
e. active

5. Scientific writing should use the _____ voice most of the time.
a. first
b. second
c. third
d. passive
e. active

6. A sentence should contain how many ideas?
a. one
b. two
c. three
d. as many as needed

7. Use a(n) _____ to provide an overview of the paragraph.
a. question
b. analogy
c. example
d. topic sentence

8. The Results section should use the _____ tense.
a. past
b. present
c. future
d. passive
e. active
f. it could use a mixture of tenses

9. The Introduction section should use the _____ tense most of the time.
a. past
b. present
c. future
d. passive
e. active
f. it could use a mixture of tenses

10. The Discussion section should use the _____ tense.
a. past
b. present
c. future
d. passive
e. active
f. it could use a mixture of tenses

11. The Introduction should follow a _____ structure.
a. tunnel
b. pyramid
c. funnel
d. linear
e. circular

12. The Materials and Methods should:
a. provide enough details and references to enable a scientist to repeat the work
b. refer to published methods but not present those details
c. include every detail of procedures followed

13. The Results section should:
a. use statistical information rather than experimental values
b. relate the results to other published work
c. be organized from least to most important
d. include control results

14. The Introduction should:
a. be the longest section
b. thoroughly review the literature
c. provide pertinent information only

15. The Discussion should:
a. avoid generalizations where possible
b. avoid unexpected findings
c. relate the results to other published work

16. A strong Title will:
a. attract readers
b. be general and inclusive
c. be short
d. be long

17. Which of the following is the strongest recommendation for taking vitamin B6?
a. Although vitamin B6 seems to reduce the risk of macular degeneration, it may have some side effects.
b. Vitamin B6 reduces the risk of macular degeneration, but it may have some side effects.
c. Taking vitamin B6 may have some side effects, but vitamin B6 also reduces macular degeneration.
d. Although taking vitamin B6 has some side effects, vitamin B6 reduces macular degeneration.

18. Which of these uses the active voice?
a. Cats are disliked by most dogs.
b. Most dogs dislike cats.
c. both use the active voice
d. neither use the active voice

19. If there is an error in this sentence, what is it?: “We observed a peak for mutant A that was higher than the other mutants.”
a. faulty parallelism
b. faulty comparison
c. noun cluster
d. vague pronoun
e. interruption between subject and verb
f. no error

20. If there is an error in this sentence, what is it?: “Spatial coupling acts on the activator variable and also the inhibitor variable.”
a. faulty parallelism
b. faulty comparison
c. noun cluster
d. vague pronoun
e. interruption between subject and verb
f. no error

21. If there is an error in this sentence, what is it?: “Manschadi et al. (2006) observed that a drought tolerant wheat genotype had more compact root architecture and a greater root length density at depth than a sensitive genotype.”
a. faulty parallelism
b. faulty comparison
c. noun cluster
d. vague pronoun
e. misdirected subject
f. no error

22. If there is an error in this sentence, what is it?: “Therefore, o,oEDDHA shows the highest effectiveness as a chelating agent for Fe^{3+} according to its stability, its transport of Fe to the roots, its transfer of Fe from the complex to plant roots, and its ability to maintain soluble Fe under calcareous soil conditions.”
a. faulty parallelism
b. faulty comparison
c. noun cluster
d. vague pronoun
e. misdirected subject
f. no error

23. If there is an error in this sentence, what is it?: “In yeast, the outgrowth of pseudohyphae, which are expanded cell types that are well adapted to foraging a substrate deeply, is a response to low ammonium availability and is triggered by the high affinity ammonium transporter Mep2.”
a. faulty parallelism
b. faulty comparison
c. noun cluster
d. vague pronoun
e. interruption between subject and verb
f. no error

24. If there is an error in this sentence, what is it?: The objective was to characterize the early winter wheat root transcriptome response to N limitation.
a. faulty parallelism
b. faulty comparison
c. noun cluster
d. vague pronoun
e. interruption between subject and verb
f. no error

25. The Discussion should be organized in a _____ structure.
a. tunnel
b. pyramid
c. funnel
d. linear
e. circular

Appendix 3: First day survey

Name: _____

Spring 2015 Pre-course Survey AGRO/HORT 403/803

Your degree sought:
Your major:

How many scientific articles (papers) have you read?
1. 0-5
2. 6-10
3. 11-20
4. >20

Have you authored and published scientific articles? If so, how many?

Have you made and presented scientific posters? If so, how many?

What type of manuscript are you working on for this class?
1. Senior/honors thesis
2. MS thesis or PhD dissertation chapter
3. Journal article
4. Other (list here):

How much of the manuscript do you have drafted right now?
1. I haven't started
2. <25%
3. 26-50%
4. 51-75%
5. >75%

How confident are you in your ability to *read and analyze* a scientific paper right now?
1. no experience
2. somewhat confident
3. moderately confident
4. fairly confident
5. very confident

How confident are you in your ability to *find and cite appropriate literature related to your manuscript* right now?
1. no experience
2. somewhat confident
3. moderately confident
4. fairly confident
5. very confident

How confident are you in your ability to ***write*** a scientific paper right now?
1. no experience
2. somewhat confident
3. moderately confident
4. fairly confident
5. very confident

Please list 3 goals for yourself for this class:
1.

2.

3.

In what specific aspects of scientific writing and communication do you feel like need improvement?

Appendix 4: Final Survey

What is your class standing, graduate or undergraduate?					
Please indicate how strongly you agree with the following statements:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Reading the four example papers was helpful					
Discussing the four example papers was helpful					
The order of the topics should not be changed					
The peer reviews/edits of my drafts were helpful					
The instructor reviews/edits of my drafts were helpful					
The in-class writing time was useful					
The pace of the course was too fast					
After this course, my knowledge of scientific writing has improved					
Using the reader/writer form improved my ability to read and understand scientific papers.					
This course has been useful to my overall education					
More time on example papers' structure would have been helpful					
The in-class writing time encouraged me to wait until class time to begin writing					
After this course, my skill in scientific writing has improved					
I would recommend this course to my peers					
The pace of the course was too slow					
After this course my ability to read and evaluate scientific papers has improved					
The textbook for this class was useful					
Reading about research of my peers helped me learn about plant science					
Editing my peers' writing helped me learn about scientific writing					
Using the reader/writer form improved my ability to organize and write my scientific paper.					
Please rank the effectiveness of each part of the course in terms of your learning, with "1" being the most effective, "2" being the second most effective, etc., down to "12" being the least effective.					
Textbook reading					
Class lectures and powerpoints					
Links and extra articles on Blackboard					
Reading the four example papers					
Discussing the four example papers					
Writing my drafts					
Searching for and reading papers to cite					
Revising my drafts using peer/instructor comments					
Reading my peers' work					
Editing my peers' work					
Reverse outlining					
Using the reader/writer form					
Please take a few sentences to explain why your "1" and "2" ranked items were the most effective.					
(Continued on back)					

	Not at all	Somewhat	Moderately	Quite	Very
How confident are you in your ability to *read and analyze* a scientific paper right now?					
How confident are you in your ability to *find and cite appropriate literature* related to your manuscript right now?					
How confident are you in your ability to *write* a scientific paper right now?					
After this class, please rate your improvement in:	None	Small	Moderate	Good	Great
Scientific writing ability					
Clear and logical presentation					
Languange/grammar/word use					
Searching for and citing sources					
Structuring a scientific paper to "tell a true story"					
Understanding the scientific writing and publishing process					
Writing an Introduction Section					
Writing a Results Section					
Writing a Discussion Secion					
Making an effective scientific poster					
How many days per week did you work on this course?					
How many hours per week did you work on this course?					
What percentage of the textbook chapters did you read?					
Is there a part of the class you wish we could have spent less time or more time on? If yes, please explain.					
How would you change this course to make it better? Any other suggestions for this course?					

Appendix 5: Student quotes about most effective class activities

Revising my drafts using peer/instructor comments:

- Revising my drafts pointed me to things I might have missed or thought I know but were wrong so that was good backstopping for me and it was effective.
- One realizes where the errors are and finds ways to improve your ideas.
- To improve my writing, writing my paper and got comments from reviewers, especially from Dr. Waters, helped me a lot.
- I was afraid of writing before this class. The structure of the class helped me write and improve in a systematic way that I can replicated outside the course.
- Revising drafts was useful because it forces you to accept that mistakes happen, and I think it makes you a more honest writer.
- Revision comments pointed out specific mistakes I was making in my writing, which told me where/how to improve.
- See how people interpret your writing and how to improve that.
- Seeing what I did wrong helped because it was my topic.

Writing my drafts:

- Writing made me realize if I understood and could use what I learned in class. If I didn't I would look back at PowerPoints, peer edits, and book.
- Practice, practice, practice
- I learned by doing.

Class lectures and PowerPoints:

- Brian is a good lecturer and presents information well that is easy to remember.
- I like the lectures and PowerPoints because they highlighted components of a good article without excessive, unnecessary detail. There was just the right balance between info and examples.
- Class lectures boiled everything down into a useable size.
- I learn more when someone explains things to me so the class lectures and PowerPoints for me was the most effective.
- I learned the most during these times because it was something new and engaged my brain well.
- The class lectures guided us how to write effectively; they were very effective lectures.

Textbook reading: The book helped to guide me through the process. (A good one)

Discussing the four example papers: I learned the most during these times because it was something new and engaged my brain well.

Editing my peers' work: Editing peer work gave me ideas for writing and made me think and use what we learned in class while editing.

Links and extra articles on Blackboard: Because it forced perspective on the important information for compiling a scientific paper.