

AGRO/HORT 403/803: Scientific Writing and Communication

A Peer Review of Teaching Benchmark Portfolio

Brian Waters
Department of Agronomy and Horticulture
University of Nebraska-Lincoln
Lincoln, NE 68583-0915
Bwaters2@unl.edu
Lincoln, NE

2014

Table of Contents

Objectives of Peer Review Course Portfolio	2
Description of the course	3
Course goals	3
Context	3
Enrollment/Demographics	4
Teaching Methods	4
Course materials and Activities	4
Teaching methods	5
The course and the broader curriculum	5
Analysis of student learning	6
Pre- and post-test on scientific writing principles	6
Improvement in scientific writing	6
Student Feedback	8
Planned Changes	11
Technical changes	11
Time on task changes	12
Conclusions	12
Appendices	13
Appendix A: Syllabus	13
Appendix B: Samples of Student Work	16

Objectives of Peer Review Course Portfolio

I chose to use this course for my portfolio for several reasons. The first reason is that this is a new course that is under development, and I want to be sure that the assessment activities match with appropriately the goals and objectives. I also want to be sure that the goals and objective have been well-thought out with student learning being the key driver of course content. This requires that student learning objectives (i.e. what should the students know at the end of the course?) are carefully planned. Secondly, I chose this course because it is a non-traditional science course, in that it is process driven rather than content driven. Thus, assessment of student learning over the course of the semester will not be documented in the usual way. I wanted to use this portfolio to plan and highlight the ways that I will document student learning. Also, it is important to document effectiveness of this course because it is an ACE10 and capstone course, and it is important to show that students are meeting the goals of these important designations.

One goal of this course portfolio is to document student improvement in knowledge of scientific writing principles and writing skill over the semester. I plan to document this in two ways. First, I give a quiz that covers knowledge of scientific writing guidelines during the first week of class, and then again during the final exam. Comparison of the scores for this quiz at each stage quantitatively shows the amount of improvement. As a second measure, I collect samples of student first draft and final version of the introduction section of the research paper, along with composite scores of standardized peer-review forms. This serves as a qualitative measure of improvement.

This course portfolio will have several uses, one of which is to evaluate ways to improve the course in future offerings. Another is to demonstrate effectiveness of the course to stakeholders. Another is to provide information for department-wide assessment activities. Additionally, this portfolio will be useful to demonstrate my teaching effectiveness for promotion and tenure.

Once concern I have for this course is time – both too much and too little. By too much, I wonder how we will fill the three weekly class periods. I can't do a traditional lecture for 3 hours a week. By too little time, I mean that I wonder how students can have time to hear a lecture/instructions, write a section of their paper, peer review other papers, and turn in the comments, all within a week for several weeks in a row. I will need to carefully plan the course.

This portfolio will focus on the main part of the course, which is writing a scientific manuscript in the IMRaD format. I want to be able to show that the students have learned writing principles, and their writing skill has been improved. I will use a before and after quiz to address the learning of writing principles. I will use a paragraph from the first draft and the final version of the introduction, and show peer review comments, to demonstrate that writing skill has improved.

Description of the course

Course goals

My course is called “Scientific Writing and Communication” (see [Appendix A](#) for syllabus). This course combines science disciplines with English and communications. The course has 3 subsections. 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.

The overarching major goal for this course is to use the formal scientific research paper format to provide a framework for student understanding of the research process and of prior coursework as they write about their own research projects. 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 audience

To accomplish these goals, students 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, they 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 focuses on developing writing and presentation skills to allow students to present understanding to a broad audience. Writing skills are developed by a) studying and critiquing previously published papers, b) learning principles of technical scientific writing, c) learning specific tactics for writing the Title, Abstract, Introduction, Methods, Results, and Discussion sections, d) writing and revising drafts of each section and the full paper, and e) peer-reviewing and critiquing writing of fellow students.

During this process, students generally come to view themselves as scientists, and to develop a new understanding of the workings of science, and the role of science and scientists in society. I hope that after this course, they have an increased ability to engage in dialog about scientific issues, better able to interpret science issues in the news, and are more interested in learning about scientific progress. For those students who will go on to research careers, I hope this that course will allow them to thoughtfully begin research projects with the end in mind, be more adept at designing experiments to address research goals, and most importantly be better at communicating science results in peer-reviewed journals, poster presentations grant proposals, and possibly engagement with the public.

Context

This course is certified as an ACE10, writing intensive course in which students will “Generate a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation, presentation, and reflection”. As mentioned, it is also a

capstone course for two majors in the Agronomy and Horticulture department. As such, one expectation is that senior undergraduates will draw upon knowledge gained in previous courses, and use this to synthesize new knowledge as they analyze and present their research. All Plant Biology majors are required to complete a research project, and most research option Horticulture majors also complete a research project. Before this course, there was not a unified mechanism for students to document and present the outcomes of their research. If the advisors choose to do so, I will work with them to prepare a standardized format for this documentation.

Students have two output products, a research paper and a research poster, either or both of which can be used in their own portfolios. It is expected that other departments will find these student products valuable and may send students to the course. Since there is increasing emphasis on undergraduate student participation in research in IANR and my department, and on using active learning as a teaching tool, this course should be of interest to a broad audience and be highly valued as a capstone.

Enrollment/Demographics

The students in this course are both undergraduate and graduate. The undergraduate students are mainly seniors, and most of them take this as a capstone course for the Plant Biology major or for the research option of the Horticulture major. The graduate students are primarily from the Agronomy and Horticulture department, but not exclusively. In the future, the course could be cross-listed with Natural Resources, Biology, and/or Biochemistry. All of the students who take this course must have conducted a research project or have access to a dataset that will allow them to write a research paper. The common background, in addition to having been involved in conducting research, is plant biology, although if the course is cross-listed then students from other areas of biology might enroll.

Enrollment is capped at 15 students. For the Spring 2014 semester, there were 10 students enrolled, representing 6 majors. Five were undergraduates, five were graduates. The majors of the undergraduate students were Horticulture (2), Plant Biology (2), and Biology (1). The majors of the graduate students were Agronomy (2), Horticulture (1), Food Science (1), and Biological Systems Engineering (1).

Teaching Methods

Course Materials and Activities

The course materials are four research papers, a textbook, and writing samples from the students themselves. Students will have homework almost every day. Out of class activities will include reading and writing reports on the four research papers, making tables and figures, writing drafts of their research paper, making their research poster, and peer reviewing.

One purpose of reading the research papers is to observe the structure of the article, that is, where certain key ideas or messages are located for maximum impact. A second purpose is to study how the authors analyzed their data, and how it was presented. The seven-part paper reports are designed to help the students locate and notice this information. A third purpose of reading the research papers is to study the scientific writing itself, at the paragraph and sentence level. I assess student performance by grading the paper reports.

I expect the students to read the sample papers and read the textbook outside of class, because it is not good use of class time for them to sit and read. I hope they work some or all of the sample problems outside of class, but we also go over selected problems during the discussion part of class. Similar to the reading assignments, I expect the students to make figures and tables outside of class. However, the students peer-evaluate the figures and tables during class. The majority of draft writing is done outside of class, again because it would not be a good use of time for all writing to be done in class. However, for each section of the paper I set one class period aside for the students to write during class while I am available for consultation. Initial peer-review takes place outside of class, then students explain their edits and comments to each other during class.

Teaching methods

Since this is a practical topic class, the lecture-only format will definitely not work. And because the best way to learn writing is to study writing and to write, we will spend much of the class in practice.

In about 40% of the class periods, I use a **lecture-discussion** style class. By this, I mean that I introduce a topic or principle, then we discuss examples or case studies. In the early part of the course we read four research papers and discuss how to interpret the results and discuss and critique how the papers are structured or put together. Over the 6 class periods where these papers are discussed, I act as the facilitator of the discussion and provide the emphasis on the key results and structure that the students need to notice in order to emulate the writing styles. The other lecture-discussion classes, begin with me presenting principles of scientific writing, then as a class we study and edit sample problems from the textbook and work on editing samples from the four research papers. In an estimated 9 class periods, students **write during class**, while I am there to help and to offer suggestions. In 10 class periods, students break into **small groups** and explain their peer-review (see below) to their fellow classmates. Five class periods are reserved for **oral presentations** of the posters.

The course and the broader curriculum

This course is intended primarily as a Capstone for senior Plant Biology and Horticulture (Plant Science option) students who have completed a research project. The course can serve as a mechanism to formally document and present the project results if the advisor wishes to do so, and the Capstone nature of the course indicates that students are expected to use scientific theory, and English and communication skills from previous coursework in analyzing, interpreting, and writing about their datasets. As such, this class acts to unify disparate elements of the overall undergraduate education. Students may or may not go on to graduate school, if so, this course will serve as preparation for planning future project, and writing theses and manuscripts for publication in scientific journals.

The course is also open to graduate students also. These students will use the course in a different way, in that in addition to integrating previous theory and skill sets, they are also preparing for the future. All graduate students have to write a thesis or dissertation to graduate, and most will also participate in drafting one or more manuscripts. Many faculty members have told me that they want

their graduate students to take a course like this, because many lack sufficient writing skills and need instruction. In this way, the course impacts most areas of the curriculum in a general way.

Analysis of student learning

Pre- and post-test on scientific writing principles

On the first day of class, I have the students take a 20-question quiz (pre-test) to establish their baseline knowledge of scientific writing principles. On the last day of class, they take the exact same quiz again (post-test). For the Spring 2014 semester, the average scores on the post-test increased from 11.3 to 15.1, a statistically significant increase of 34% (Table 1).

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. As useful as this measure is, I suspect that it underrepresents the actual improvement, and that the test could be refined. When the results are analyzed by question, the average improvement was 38%. However, looking at individual question scores it becomes clear that five of the questions had a baseline (pre-test) score of 90%, leaving little potential for improvement. As such, I could revise or replace those questions with better ones. There were two questions where the scores actually decreased at the post-test level, indicating that I need to increase emphasis on those principles during class. On a positive note, some questions saw increases of 133, 200, and 600%, indicating a large improvement in knowledge of scientific writing principles.

Student No.	Pre-Test	Post-test	% increase
1	10	13	30
2	11	14	27
3	12	16	33
4	10	15	50
5	12	16	33
6	11	14	27
7	12	18	50
8	11	11	0
9	15	17	13
10	9	17	89
Mean	11.3	15.1	34
sd	2	2	24
t-test		0.000401	

Table 1. Pre- and post-test results.

Improvement in scientific writing style

It is possible that students could have excellent knowledge of scientific writing principles and still write poorly. Therefore, it is important to also have a qualitative measure of writing improvement. I accomplished this by monitoring common writing errors in first draft and final draft versions of student papers. Here, I will show changes in frequency of common errors for three sections of the final paper.

Introduction

The Introduction section is one of the most important in a scientific publication, because (done properly), it establishes the background, defines the knowledge gap that is being addressed, defines the research question to be answered, and lists the specific objectives of the work. The Introduction also can provide a preview of the approach, findings, and their significance, to set expectations for the reader. If the Introduction is not signaled correctly, is missing or has obscured elements, or has irrelevant information, the reader is left confused and unsure of what to expect in the rest of the paper. It is also important for the author to use the active voice and correct tense. The students showed substantial improvement in most of the common errors of the Introduction section (Fig. 1)

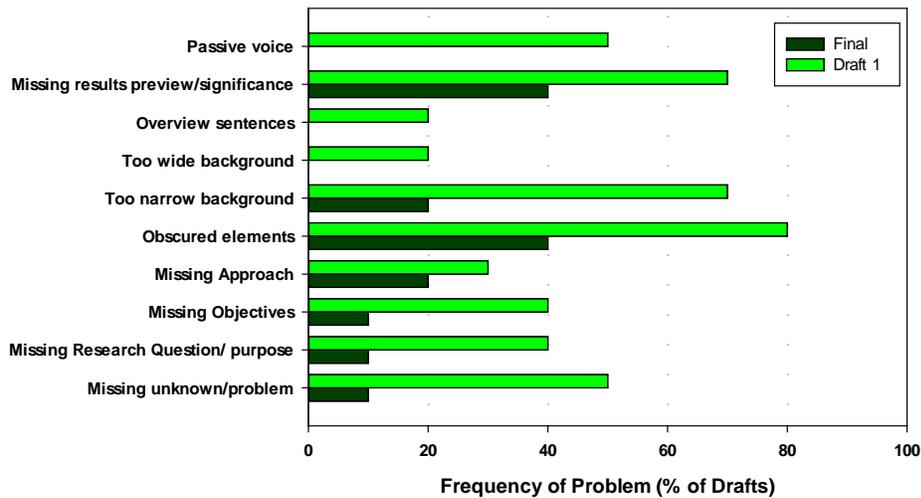


Fig. 1. Frequency of common errors in the Introduction section first draft and final version in Spring 2014.

Results

The results section is often difficult to write for students. I teach them to tell their readers the result, not the data (which is in the figures or tables), not to use a statistic as a result, to emphasize the most important results, and most challengingly, to interpret the result for the reader without crossing the line into discussion. I teach them to organize each result into a repeating pattern of: purpose, approach, result, and interpretation. As for the Introduction section, the students showed substantial improvement in most of the common errors of the Results section (Fig. 2).

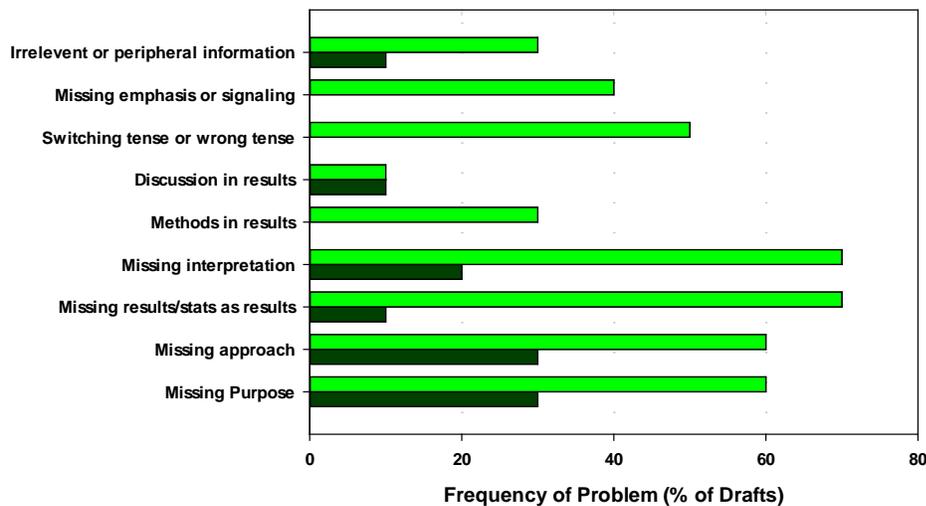


Fig. 2. Frequency of common errors in the Results section first draft and final version in Spring 2014.

Discussion

The Discussion section is the most important part of the paper. The section should reflect the Introduction, and within the first paragraph describe how the findings answered the research question that was established in the Introduction. It should be written in the active voice, and in a mixture of tenses, dependent on context of the result that is being discussed. The results should be put into the greater context of the background established in the Introduction, and generalized to extrapolate to

new situations. Importantly, the significance of the findings should be made clear. Again for this section, I was pleased with the improvement in the frequency of common errors (Fig. 3).

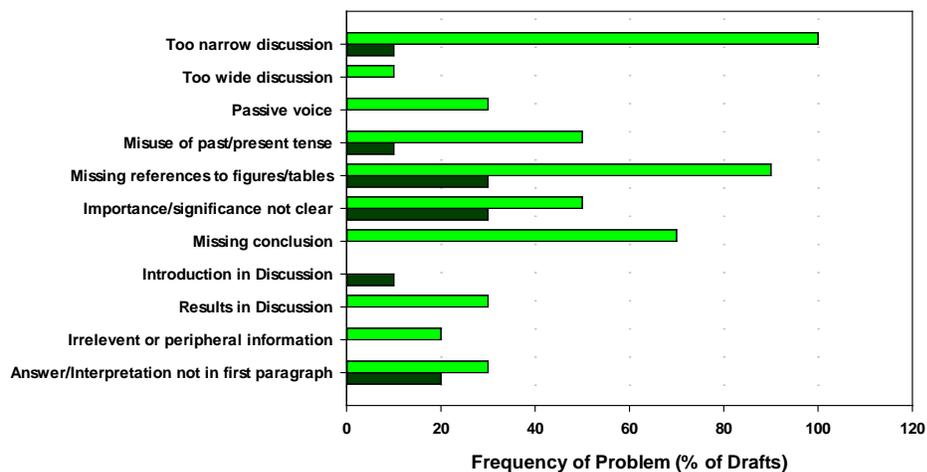


Fig. 3. Frequency of common errors in the Discussion section first draft and final version in Spring 2014.

Specific examples of Introduction section

To show specific examples of improvement in scientific writing style at the sentence level, I have included annotated paragraphs of the Introduction section in [Appendix B](#) of this document. All students signed Informed Consent forms to allow examples of their work to be used for this purpose. The first example shows improvements in word choice and specificity of ideas in the writing. The second example shows improvements resulting from condensing sentences and improved word choice. The third example shows improvement by making edits to shift from the passive voice to the active voice, partly by choosing the correct subject for each sentence. In the fourth example, this Introduction paragraph should contain the statement of the “unknown”, or knowledge gap that is being addressed, but did not in the first draft. There were also improvements made in specificity of key terms.

Student Feedback

Since this was my first time teaching this course, I wanted to know student opinions about what was working well and what I needed to change for the next course offering. To obtain this information, I asked the students to participate in a multi-part survey. 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”. The results of this survey (Fig. 4) were very useful to me, as they 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. 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. 90% of the students agreed or strongly agreed that the in-class writing time was useful. 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. Important to the course as a Capstone, 80% of the students agreed or strongly agreed that reading about the research of their peers helped them learn about plant science.

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The instructor reviews/edits of my drafts were helpful					10
After this course, my <u>knowledge</u> of scientific writing has improved				2	8
<u>Discussing</u> the four example papers was helpful				3	7
This course has been useful to my overall education				3	7
<u>Reading</u> the four example papers was helpful			1	3	6
The peer reviews/edits of my drafts were helpful			2	2	6
After this course, my <u>skill</u> in scientific writing has improved				5	5
I would recommend this course to my peers				5	5
The in-class writing time was useful			1	4	5
After this course my ability to <u>read and evaluate</u> scientific papers has improved				6	4
<u>Reading</u> about research of my peers helped me learn about plant science		1	1	5	3
<u>Editing</u> my peers' writing helped me learn about scientific writing				8	2
The order of the topics should not be changed		2	1	6	1
The textbook for this class was useful.	2		2	5	1
More time on example papers' structure would have been helpful		4	3	2	1
The pace of the course was too fast		5	3	1	1
The in-class writing time encouraged me to wait until class time to begin writing	1	7	1	1	
The pace of the course was too slow	1	7	2		

Fig. 4. Results of student survey, part 1, in Spring 2014.

I also asked some open-ended questions to better understand the workload of the course (Fig. 5). I was surprised by the number of days per week (3.4 on average) and hours per week (6.1 on average) students reported spending on the course, in that I expected higher numbers for both. On the other hand, it was clear from some of the drafts that students had not spent enough time on task before the deadline. I expect that these numbers will increase somewhat in the next offering of the class as I refine and present my expectations to the next class. I did not know what to expect for the percentage of assigned textbook chapters read, but it was reported to be 34.5%. This was not terribly surprising, as I presented most of the textbook information in class lectures and provided PowerPoint slides of this information.

Open ended questions:	G	G	G	G	G	UG	UG	UG	UG	UG	Mean	SD
How many days per week did you work on this course?	3.5	3.5	3	3	4.5	2.5	4	3	3.5	3	3.4	0.5798
How many hours per week did you work on this course?	5	12.5	4	2	6.5	9	6.5	4.5	6.5	4.5	6.1	2.9326
What percentage of the textbook chapters did you read?	10	30	60	20	50	90	10	50	25	0	34.5	27.734

Fig. 5. Results of student survey, part 2, in Spring 2014.

The last part of the survey focused on effectiveness of tasks. My goal was to learn which parts of the course had contributed most to overall student learning. I compiled a list of 13 tasks that students performed during the semester and asked students to rank the tasks from most to least effective. I used combinations of the mean, median, and mode rank for each task to order the list, as these values didn't always rank in the same order. While there was some variability in rankings (Fig. 6), it was clear that the top activities included writing, discussing example papers, revising, and peer reviewing. The lowest ranked tasks were the textbook readings and the extra articles I posted on the course Blackboard site, although I do not interpret lowest rank to mean that these tasks were not helpful.

Please rank the effectiveness of each part of the course in terms of your learning, with 1 being the most effective.

Rank	Task	G	G	G	G	G	UG	UG	UG	UG	UG	Mean	Median	Mode
1	Writing my drafts	1	1	7	5	3	3	1	8	2	4	3.5	3	1
2	Discussing the four example papers	5	2	9	3	7	2	4	1	3	10	4.6	3.5	2
3	Revising my paper for the final version	3	8	4	11	1	9	3	10	5	2	5.6	4.5	3
4	Peer reviewing/editing	2	7	3	8	4	8	5	5	1	5	4.8	5	5
5	Revising my drafts using peer comments	9	4	6	6	2	6	6	7	4	1	5.1	6	6
6	Searching for and reading papers to cite	6	3	8	4	12	5	9	11	6	3	6.7	6	6
7	Reading my peers' work	8	6	2	9	6	11	10	6	10	7	7.5	7.5	6
8	Editing my peers' work	7	5	1	13	5	12	11	12	7	6	7.9	7	7
9	Reading the four example papers	4	9	10	2	11	1	12	3	9	9	7	9	9
10	Reverse outlining	11	10	5	12	8	4	2	13	11	8	8.4	9	11
11	Class lectures and powerpoints	10	11	12	10	9	10	7	2	12	11	9.4	10	10
12	Textbook reading	13	10	11	7	10	7	13	4	8	13	9.6	10	13
13	Links and extra articles on Blackboard	12	12	13	1	13	13	8	9	13	12	10.6	12	13

Fig. 6. Results of student survey, part 3, in Spring 2014.

One interesting and surprising finding was that the undergraduate and graduate students ranked the tasks differently. The top 5 tasks were similar between these groups, but not necessarily in the same order. However, the tasks that were ranked 6-11 in effectiveness overall were quite differently ranked when broken down into these groups (Fig. 7). For example, undergraduate students found more value in “searching for and reading papers to cite” and “reading the four example papers” than did the graduate students. My interpretation of this is that the graduate students likely had more experience with these tasks, while it was something new for the undergraduate students, some of whom had never read a research paper before taking this class. Similarly, graduate students ranked “editing my peers’ work”

and “reading my peers’ work” more highly than did the undergraduate students. Again, I interpret this difference to the greater level of experience with reading scientific literature than the undergraduates, in that since they are already familiar with the format and the literature of their field, they were able to get more value from evaluating the writing itself than were the undergraduates.

Overall Rank	Task	Undergrad Rank	Graduate Rank
1	Writing my drafts	1	1
2	Discussing the four example papers	2	3
3	Revising my paper for the final version	5	4
4	Peer reviewing/editing	3	2
5	Revising my drafts using peer comments	4	5
6	Searching for and reading papers to cite	6	8
7	Reading my peers' work	10	7
8	Editing my peers' work	12	6
9	Reading the four example papers	7	9
10	Reverse outlining	8	10
11	Class lectures and powerpoints	9	12
12	Textbook reading	11	11
13	Links and extra articles on Blackboard	13	13

Fig. 7. Results of student survey, part 3, in Spring 2014. Overall rank is shown on the left side, and broken down by undergraduate or graduate student status on the right side.

Planned Changes

Although I feel the course was successful during its first offering, as we went through the semester I made a list of what I would change for the next time to make the class even better. Below, I will discuss these changes in two categories, “technical changes” to the way the course is administered, and “time on task” changes to the schedule during the semester.

Technical changes

The first change has to do with the first activity, the pre-test/post-test. As described above, I can refine or replace some of the questions so that I can more accurately capture improvement in knowledge of scientific writing principles. The second change deals with the second task, which was written reports the students turned in that summarized their reading of the four “example paper” journal articles. I used a form that I had used in a previous course, but I will revise this form to make it reflect more closely the instructions for the writing assignments. The third change is simple, to give specific instructions to the students on how to format their drafts (file naming, double spaced, line numbers, page numbers, name in header, add each new section to existing document), but will make a big difference for file management for me as the instructor. The next change will be to give additional feedback on the student drafts about common style problems, in addition to my editing and general comments.

The next change is a bigger one, which is to require revisions after each feedback loop (e.g. before adding Materials & Methods, do revisions for Introduction). I did not do this before, and students moved on to the next assignment instead of making edits while the material was fresh. This was a mistake on my part, because in effect it meant fewer revisions for the final product and lost momentum. I will also emphasize the revision process, and encourage the students to not just make the suggested

changes, but to make their own edits also. I provided checklists for peer reviewing previously but did not require their use, and I probably will require their use next time.

Lastly, I will be in contact with student advisors regarding my expectations for them in regard to helping the students with writing. Since advisors are typically the source for the ideas behind the student research projects that are being written up in my course, they have the greatest knowledge of the concepts and literature. It is also typical in my field for advisors and students to co-author research papers, by taking turns writing a single document. If I do not make it explicitly clear that the student is to be the sole author of the work for this class, the advisor could unintentionally put the student at risk for plagiarism if he or she contributes writing to the student project. This became clear to me during the course, so I will take precautions in the future and let the advisors know that they are not to help the students write their papers.

Time on task changes

Since the example papers were considered to be so helpful by the students, I would like to study them in more detail to increase their usefulness even more. For this, I will find additional example papers and hand out 1-page examples for the Introduction, Results, and Discussion sections, and have students mark them up in class, finding the key elements in each. This will probably take two additional class periods. Another change will be to require a reference list early on, before the first writing assignment is due. For this, I will add one additional class period. I had considered doing away with the in-class writing sessions, because students rarely asked me questions as was intended, and I suspected that some students waited until class time to begin writing. However, the class survey indicated that that in class writing time did not encourage them wait to begin writing, so I will keep some in-class writing time, but reduce it from one class period per section to less than a full class period. Finally, I will add an additional assignment to the class, which is to do a “reverse outline” after the drafts for all the sections have been written, but before the students edit the full draft. I had them do this in class last semester, although it was not on the assignment list. It didn’t help all the students, but for the ones that were helped, it was very useful.

Conclusions

Participating in the Peer Review of Teaching Program during the time I was planning and teaching this course was extremely useful. During the planning stages, it helped me think about the context and content of the course, and to define measureable objectives and design the course to meet them. It helped me to think about collecting data to determine exactly what worked and what needed to be changed. Because of this preparation and reflection, the course went very well, even better than I expected. I consider my course a success with room for making it an even bigger success in the future.

Appendices

Appendix A: Syllabus

AGRO/HORT 403/803: Scientific Writing and Communication (Capstone) Spring Semester 2014 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 by Angelika H. Hofmann. Oxford University Press, ISBN 978-0-19-539005-6

Access to a computer, 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

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

20% 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 format, 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 (7 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 (2 weeks)

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 B: Samples of Student Work

1. Kuhar original Introduction (word choice, lack of specificity)

Despite the success story of corn ethanol, the process of converting starch into liquid fuel by fermentation is projected to be inadequate, considering the challenges set by the US government to fulfill 30% of total liquid fuel for transportation from biomass by 2030 (reference). Growing dedicated energy crops and converting their holocellulose to liquid fuel, is a more attractive and feasible approach. Hence, alternative feedstocks are needed to support ethanol production. It also resolves the fuel versus food and feed arguments that are being debated currently. There is a need for cellulosic biomass feedstocks that exhibit high biomass productivity with suitable conversion characteristics for biofuel production to meet renewable fuel mandates.

Final Version

The United States government has a target to supply 30% of its total liquid fuel from renewable biofuels by 2030. Corn ethanol will likely be inadequate to feed the overwhelming demand for gasoline (Somerville 2007). Dedicated energy crops to produce liquid fuel are another attractive and feasible approach to meet renewable fuel mandates. There is a need for cellulosic biomass feedstocks with high biomass productivity and suitable conversion characteristics for biofuel production.

Commented [BW1]: Refers to something not stated; negative point of view

Commented [BW2]: wordy

Commented [BW3]: awkward and wordy

Commented [BW4]: reference missing

Commented [BW5]: wrong position in sentence

Commented [BW6]: incomplete comparison

Commented [BW7]: vague pronoun

Commented [BW8]: refers to something not stated

Commented [BW9]: passive voice; unknown actors

Commented [BW10]: passive voice; wrong subject

Commented [BW11]: Broad, fact-based, specific statement

Commented [BW12]: correct subject

Commented [BW13]: correct subject

2. Loseke original Introduction (condensing, word choice)

The best practice for avoiding winter and spring freeze injury is appropriate site selection. However, in many cases site selection is not a priority and vineyards are established in not the most suitable locations. To offset poor site selection, many methods to provide frost protection have been attempted and include wind machines, overhead irrigation, and chemicals. With the above methods being very costly, many small growers cannot afford to employ such methods. In the event of late frost, growers hope the frost injury will affect only the primary bud, and secondary buds will recover growth after primary bud damage (Orunfleh & Read, 2010). Protecting the primary bud is essential as they produce 300 to 400% more fruit with clusters 135 to 190% larger than what are produced by secondary buds (Wiggans, 1926). A study of the relative value of fruiting shoots arising from primary and secondary buds of the 'Concord' grape.

Final Version

The best practice for avoiding winter and spring freeze injury is appropriate site selection. However, in many cases vineyards are not established in the most suitable locations. To mitigate freeze-prone sites, many methods to provide freeze protection have been attempted and include wind machines, overhead irrigation, and chemicals. These methods are very costly and are not economical for small growers. Protecting the primary buds is essential as they produce 300 to 400% more fruit with clusters 135 to 190% larger than those produced by secondary buds (Wiggans 1926).

Commented [BW14]: negative point of view

Commented [BW15]: negative point of view

Commented [BW16]: passive verb

Commented [BW17]: negative point of view

Commented [BW18]: incorrect term

Commented [BW19]: awkward phrasing

Commented [BW20]: irrelevant information; incomplete sentence

Commented [BW21]: factual point of view

Commented [BW22]: Condensed and factual

3. Loseke original Introduction (active voice)

Plant growth regulators have also been used in the attempt to delay bud break in grapevines. Lavee and May (1997) mentioned that applications of exogenous gibberellic acid during the previous growth season will delay and inhibit bud opening in the following growing season. Nigond (1960) sprayed 'Aramon' vines with NAA at 500 to 1000 ppm in October, January, February, and March. There was no effect with the October application, but by spraying the vines in January, February, and March he reported a delay in bud break of 16-27 days. (Qrunfleh & Read, 2010) did a similar study in Southeast Nebraska on 'Edelweiss' and found Amigo Oil significantly delayed bud break up to 12 days when compared to the non-sprayed control. He also found that 1000 ppm NAA delayed bud break by 3 days when compared to the non-sprayed control vines.

Final Version

Plant growth regulators have also been used to delay bud break in grapevines. Application of exogenous gibberellic acid during the previous growth season delays and inhibits bud opening in the following growing season (Lavee and May 1997). Spraying 'Aramon' vines with 1-Naphthaleneacetic Acid (NAA) at 500 to 1000 ppm in October had no effect, but spraying the vines in January, February, and March delayed bud break by 16-27 days (Nigond 1960). Qrunfleh and Read (2010) did a similar study in Southeast Nebraska on 'Edelweiss' vines and found Amigo Oil significantly delayed bud break up to 12 days when compared to the non-sprayed control. 1000 ppm NAA also delayed bud break by three days when compared to the non-sprayed control vines.

4. Student #3 original Introduction (missing "unknown", lack of specificity)

CSR phenotypes such as EVI estimates can be used in genomic selection (GS) models to improve selection for NUE traits. The first objective of this study is to determine if EVI phenotypes can be predicted with good accuracy using GS models. The second is to compare prediction accuracy of EVI phenotypes with those of plant productivity parameters previously used in GS models. Successful development of a NUE genomic selection model using EVI or other CSR phenotypes will lead to the release of NUE hard winter wheat genotypes and reduce the cost of nitrogen fertilization in the environment.

Final version

CSR phenotypes such as EVI estimates can be used in genomic selection models to improve selection for NUE traits. However, it is unknown how accurately genomic selection models can predict CSR

Commented [BW23]: unnecessary

Commented [BW24]: The reference should not be the subject of the sentence

Commented [BW25]: passive voice

Commented [BW26]: passive voice

Commented [BW27]: incorrect subject

Commented [BW28]: condense to one sentence

Commented [BW29]: incorrect subject

Commented [BW30]: correct subject, active voice

Commented [BW31]: active voice

Commented [BW32]: correct subject

Commented [BW33]: correct subject

Commented [BW34]: vague term, needs to be defined

Commented [BW35]: vague

phenotypes. The first objective of this study was to determine if EVI phenotypes predicted with genomic selection models show correlations with observed phenotypes greater than 0.3. The second objective was to compare prediction accuracy of EVI phenotypes with those of plant productivity parameters such as physiological maturity, plant height, or grain yield previously used in genomic selection models. For this study we used a panel of 299 hard winter wheat varieties that were genotyped with the 92K iSelect wheat chip (Wang *et al.*, 2014). CSR values were collected weekly over a five week grainfilling period and used to calculate EVI values for use in a genomic selection model. Agronomic plant productivity parameters such as yield were also included in the genomic selection model. Successful use of genomic selection using CSR phenotypes could lead to improved NUE hard winter wheat genotypes and to reduce nitrogen fertilization.

Commented [BW36]: Clear statement of "unknown" that is addressed by this work

Commented [BW37]: Much more specific