Supplemental Material

CBE—Life Sciences Education

Weaver *et al.*

SUPPLEMENTAL MATERIAL

Appendix A. Senior thesis requirements for the Biology Department at the University of La Verne.

Biology Department, Senior Capstone Thesis Requirement

All students completing a baccalaureate degree in the Biology Department are required to complete a senior capstone experience that entails both a research, writing, and presentation component. At the end of the project, students will be required to submit a written thesis to the research advisor and department chair of biology, as well as to give a 13-minute talk on their senior capstone in front of the invited La Verne community.

Requirements for the written thesis:

- Title page with proper heading, project title, name, and date
- Signature page with signatures from the advisee, research advisor, and department chair
- 25-page minimum (not including title and signature page, acknowledgements, and work cited)
- 20 primary sources (minimum) organized in proper APA citation
- Work cited of all the included primary sources
- Final advisor approval
- Final Department Chair approval

Appendix B. Guidelines for preparing drafts for peer review used in peer review training during research methods and biostatistics.

Research Methods and Biostatistics

Guidelines for Preparing Working Drafts of your Research Proposal

Before you prepare your draft, determine the following:

What is your aim or purpose? Are you trying to describe, analyze, or argue?

Who is your audience?

What point of view should you use? What tense?

What section of your thesis are you focusing on?

Try to focus on precisely the point you are trying to convey to your audience. Does it make sense? You might refer to the guidelines for responding to peer drafts (see handout) for some general things that others will be looking for in your paper.

Spend as much time on prewriting techniques* as you need to. Once you feel you have spent sufficient amount of time planning, then begin drafting your ideas into complete thoughts. It is important to get your ideas on paper; therefore, you should try and save the revision process until the end of your completed draft. Once you have a completed draft (remember this is a rough draft!), revise the pages as much as you can before the workshop. You want to provide your group with a draft that is as polished as **you** can make it. Be ready for lots of feedback from your group.

On draft due dates, bring to class 4 or 5 copies of your paper (one for me, one for each of your group members, and one for yourself). I will not be writing comments on your papers; however, I will be reading them so that I can participate in group discussions during workshop.

Be sure to double space and use 1 ¼" margins so that your peers have enough room to write their comments and/or suggestions on your paper. Anything less than double space and 1 ¼" margins is simply not enough room for your peers to critique effectively. Anything more than this indicates you have not met the minimum page requirement and limits the amount of helpful feedback from your group members.

*The initial creative stage of writing, prior to drafting, in which the writer formulates ideas, gathers information, and considers ways in which to organize the information; planning.
<academic.laverne.edu/~ear//Cscs/Glossaries.pdf>

Resources for prewriting techniques:
http://faculty.ncwc.edu/lakirby/English%20090/prewriting_strategies.htm
http://blog.eduify.com/index.php/2010/02/09/the-5-best-prewriting-techniques/
http://owl.english.purdue.edu/owl/resource/673/01/
http://www.simpson.edu/hawley/writing/prewriting.html

Research Methods and Biostatistics

Guidelines for Preparing Peer Response Critiques

The purpose of peer review is to provide and receive critical analyses of your written documents; it is to allow a writer to get others' responses and perspectives on a particular piece so that he/she has a **basis for improving the writing**. Your goal as a peer critic is to be supportive in two ways: honest about what is good and painfully honest about what is not good. Assume that the paper you are reading can and should be better. That is not to say that many things about the paper are not good, but as a reader, strive to be honest with what is both positive and negative about the papers.

Before workshop, you should spend approximately 45 minutes on each research proposal draft, thinking about and providing written responses to each proposal. You will have a copy of each of your group members' papers; use that copy to write down as many questions, suggestions, and statements about what you read as you can. Using the guidelines attached, provide as many written comments as you can to the writer. Be as detailed in your suggestions as possible.

On the day of workshop, you will get into your groups and discuss each member's paper. Remember to keep your eye on the clock and allocate an equal amount of time to each member. After you discuss your comments with the group, you will give that member the draft back (with your written comments on it), so feel free to mark/underline/ highlight/circle specific passages on the paper itself. **Be sure to write out comments on specific sections, paragraphs, passages, and sentences within the paper as well as provide a more general, holistic response to the draft at the end.** After you workshop, you should revise your proposal as soon as possible while comments are fresh in your head.

A few general hints about giving and receiving responses:

TO THE WRITER- toughen up, develop a thick skin, and welcome the criticism and the variety of suggestions. Do not expect or look for bouquets, praise, or complements. You are here because you know you can improve your writing, and unless others can point out to you where and how you need to improve, your writing will not change. Demand criticism from your colleagues - do not settle for praise and warm fuzzies. The time to "feel good" is when your assignment is completed.

TO THE READER- do not let up; do not let the writers ease by. You have a responsibility to bring to the paper all the critical reading and writing skills that you have and are developing. You need to look for aspects that are not clear, sections that make inappropriate assumptions on the part of the reader. Question every section, paragraph, and sentence. Look for stated rather than implied information (e.g. is the purpose of the proposal stated or does it merely come across after you read the entire section?). If you cannot follow or understand a point, tell the writer; do not give the writer the benefit of the doubt or assume you have just missed it or the paper was discussing some aspect of science you simply do not know much about.

Remember, you are not an editor or a proofreader. Save your time and efforts in this realm. Provide general comments about the grammar (e.g. you have a number of vague pronouns, many of your sentences are not parallel, you overuse the comma, and you overuse the conjunctive adverb), but do not mark each mistake and do not correct the grammatical/ mechanical errors. Instead, look for and comment on specifics in the following areas: audience, purpose, focus, structure, organization, arguments, analyses, use of literature, and general style.

A note of caution: Being critical is not the same as being mean. The purpose of these exercises is to improve our writing, not to destroy anyone's confidence. It is just as important to point out what the writer does well, as to point out what needs work. Both types of feedback are essential in developing writing skills.

Appendix C. Guidelines for peer review - responding to peer drafts.

Use the following guidelines to respond to your peers' papers.

1. Read the entire draft without marking anything or making any comments. Think about the type of document, the function of the document, and the audience to whom the document is written.
2. A good manuscript should communicate to a specific audience. As you reread and begin to respond to your peers' papers, first comment on whether the type of document (e.g. an introduction to the thesis) functions as it should (e.g. provides a rationale, not just the fact from the literature) and communicates to the appropriate audience (e.g. your adviser). Comment on how well the paper as a whole communicates as it should.
3. Does the section you are reading have an introductory paragraph (to what section)? Do you know the purpose of the paper or section? Do you have an idea of what the writer will develop/discuss in that section? If not, you need to ask the writer to give you more direction, more focus, more of a reason to read on to the rest of the paragraph or pages.
4. Does the writer provide a direction or purpose for each paragraph (topic sentences)? When you read the first sentence or two of each paragraph, you should get a sense of how that paragraph will be developed, what the writer will talk about? Does the writer seem to skip form one point to another in the paragraph? If so, point that out and suggest a focus or a way that the writer could develop only one or two issues in each paragraph.
5. Look for connections within paragraphs. Do the sentences come across as separate ideas that are not particularly related to each other? Point out sentences in which ideas do not come across cohesively, in which the point of the sentence does not seem to connect with the point of the sentence before or after it.
6. Look at the connections between paragraphs. Does one paragraph lead into the next? Does one paragraph pick up where the previous one left off? Do you understand why the writer moved from one thought to another? Is that "why" clearly articulated or do you have to guess? Point out to the writer where the connections are not clear or where you as a reader had to work too hard to figure out what the connections were.
7. The content should provide the reader with facts and researched information, but it should also provide a context for that information and discuss the importance of or the writer's interpretation of the research. To what extent and how well does the writer go beyond just simply reporting on the information? Point out specific places in which you are given all research, all facts, but no discussion of significance or rationale.
8. Point out sentences that are too convoluted or too filled with jargon for you to understand. Do not rewrite the sentences; instead, point out specific words, phrases, and sentences that need to be rewritten. As the semester progresses, you will be able to use the grammatical/stylistic language to articulate the weakness or error; for now, simply try to point out awkwardness.
9. Finally, point out the most interesting, insightful, or articulate paragraph(s). Then, point out the paragraph(s) that need the most improvement; tell why it needs to be improved and suggest one way the writer could improve that section.

Appendix D. Rubric used for assessing biology senior research theses (adapted from AAC&U VALUE rubrics – Inquiry and Analysis and Written Communication).

	Capstone 4	Milestone 3	2	Benchmark 1
Existing Knowledge, Research, and/or Views	Demonstrates a thorough understanding of context and audience by synthesizing in-depth information from relevant sources. Represents various points of view/approaches and logically addresses a gap in the literature.	Demonstrates adequate consideration of context and audience by synthesizing in-depth information from relevant sources. Represents various points of view/ approaches and clearly presents a gap in the literature.	Demonstrates awareness of context and audience by presenting information from a minimum of 4 relevant sources. Represents limited points of view/approaches & mentions a gap in the literature but with limited clarity or support.	Demonstrates minimal attention to context and audience by presenting information from irrelevant sources. Represents limited points of view/approaches with no mention of a gap in the literature.
Design Process	All elements of methodology or theoretical framework are skillfully developed. When relevant, appropriate methodologies or theoretical frameworks are synthesized from across disciplines. Explanations of methodological choices are clear and demonstrate an expert understanding of both the rationale for and the implication of the methodology.	Critical elements of the methodology or theoretical framework are appropriately developed; explanations of methodological choices are clear and demonstrate an understanding of the rationale for choosing the methodology.	The methodology or theoretical framework is largely developed but shows weakness in places. Explanations of the methodological choices are present but at points lack clarity or demonstrate an incomplete understanding of the rationale.	The methodology or theoretical framework is present but with significant weakness or flaws. Explanations of the methodological choices are present but at key points lack clarity or demonstrate an incomplete or flawed understanding of the rationale.
Analysis	Organizes results/evidence to reveal insightful/important patterns, differences, or similarities related to focus.	Organizes results/evidence to reveal basic patterns, differences, or similarities related to research focus.	Organizes results/evidence, but the organization is ineffective in revealing more than basic patterns related to the research focus.	Offers a discernible but flawed organization of the results/evidence, often in the form of a list rather than analysis. Does not effectively reveal patterns related to the research focus.
Conclusion, Sources, and Evidence	States a skillful conclusion that logically extrapolates from the use of high-quality, credible, & relevant sources to develop ideas. Gives two or more evidence of sources. Presents statistics/evidence from the appropriate discipline & application.	States a limited conclusion restricted to the inquiry findings. Demonstrates consistent use of credible, relevant sources to support ideas. Gives one source of evidence. Statistics/evidence from appropriate discipline & application are specific to support ideas.	States a general conclusion with an overall statement of findings. Demonstrates an attempt to use credible and/or relevant sources to support ideas. Includes supportive statistics/evidence of findings but is outside the scope of the project.	States an ambiguous, illogical, or unsupportable conclusion. Demonstrates an attempt to use sources to support ideas in the writing.
Limitations or Implications	Insightfully discusses in detail relevant and supported limitations, application, or broader significance. Must address two of the three.	Discusses relevant and supported limitations, application, or broader significance. Must address two of the three.	Presents relevant and supported limitations, applications, or broader significance	Presents limitations, applications, or broader significance; however, they are irrelevant or unsupported.
Control of Language and Flow	Organizes ideas and information in a seamless and logically coherent manner. Uses expert language that skillfully communicates meaning to readers and is virtually error-free.	Organizes material in a generally coherent manner, with few gaps in the logical progression of ideas and information. Uses straightforward language that generally conveys meaning to readers. The language in the portfolio has few errors.	Lacks clear logical coherence at points in the presentation of ideas and information. Uses language that generally conveys meaning to readers. Lacks clarity and writing includes some errors.	Fails to logically cohere at key points, impeding readability. Uses language that sometimes obscures meaning due to errors in usage.