Journal Article Critiques: A Complement to Upper-Level Engineering Courses

Shelia Barnett¹ and Renee Rogge²

Abstract

Many upper-level discipline-specific engineering courses are taught in the lecture format. This format often does not allow the instructor adequate time to cover topics of interest to the students in enough depth to satisfy the students’ needs. In two upper-level courses in Mercer University School of Engineering, journal article critiques serve several purposes including encouraging individual, in-depth research on a topic of interest, emphasizing writing in the curriculum, developing life-long learning skills, and encountering contemporary issues in the students’ chosen specialties. However, the primary purpose is to develop the students’ critical thinking skills.

The students perform a critique of a recently published, peer-reviewed journal article in their appropriate fields of study. The student-selected article is in a field of interest to the student, yet relevant to the course. The students critically assess each section of the article: introduction, methods, results, and discussion. The critique also includes supporting information from outside references. Student critiques are evaluated primarily for clarity of writing, thoroughness of the critique and justification of article criticisms.

In the initial offering of the courses, the students commented on the complexity of the terminology and the article length. With perseverance they understood the importance of the research and the details of the methodology. They discussed improvements needed to make the article more understandable to a new person in the field and often had valid criticisms. The students expressed overall satisfaction with the assignment, specifically in how the assignment combined classroom and real-world experiences. The instructors were equally satisfied with the assignment, especially with some of the advanced critical thinking skills demonstrated by the students. The instructors recommend the assignment when appropriate and will incorporate it into their future courses.

Introduction

It is difficult, if not impossible, to cover all the topics of interest to each student in many upper-level engineering courses. An assignment requiring students to critically assess a current journal article encouraged each student to learn more about a topic of interest to them. The assignment was also intended to develop critical thinking skills, to emphasize writing in the curriculum, and to develop life-long learning skills. Students also encountered contemporary issues in their chosen specialty.

The authors gave students in Industrial and Biomedical Engineering specialties at Mercer University the journal article critique assignment in Human Factors (ISE 412) and Biomechanics (BME 412), respectively. Each of these classes was comprised of senior engineering students.

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The following text discusses assignment details, critique assessment, and instructor observations regarding the benefits and drawbacks of the assignment. Recommended improvements to the assignment are discussed in the "Lessons Learned" section.

**Format of Assignment**

Students were required to select a peer-reviewed journal article published within the past 3 years. However, the article must be relevant to the course and the students were encouraged to select a topic of special interest to them. After reading the article, the students were asked to submit a critique consisting of the following sections: summary, background/introduction, methods, results, conclusions, and references. Guidelines were provided for each section of the critique. The guidelines were provided to focus the student's attention on the importance of the analysis and synthesis of the article's findings, i.e. not just generating a report. The students were instructed to use outside resources to support their observations. The critique guidelines, as given to the students, were as follows:

**Summary:** The purpose of this section is to identify the purpose of the research article and the hypotheses of the authors. The approach taken in the research and the general findings are to be briefly discussed.

**Background/introduction:** This section is intended to answer the following questions: What is the problem? Why is it important? Have other studies been conducted that are similar, what did they find, and what methods were used? Is the introduction sufficient? Did you need additional references to understand the background information?

**Methods:** The following questions are to be answered here: What methods were used and why were they chosen? How are they different from previous approaches to similar research? What was good or bad about the approach from your point of view? What would you have done? Why?

**Results:** Questions to be answered here include: What results do the authors present and how are they presented? What else could have been reported? Do the results make sense? How would you change the results section?

**Conclusions:** This section is intended to address the following questions: What did the paper contribute to the field of biomechanics (human factors)? What did you learn? Do the conclusions of the paper make sense and what were they? How do you feel in general about the article? What would you do to improve this research?

**References:** References should conform to a style selected by the instructor.

**Assessment of Student Critiques**

Students were responsible for providing copies of their respective articles to the instructor on or before the assignment deadline. The instructor read the student's article prior to evaluating the student's critique. We felt this was an important step as it gave the instructor the background necessary to adequately evaluate the student's critique and alerted the instructor to potential plagiarism. The instructor also benefits by learning more about topics outside his or her specialty.

For our purposes, each instructor used the same evaluation criteria for the journal article critiques. A sample score sheet may be found in Table 1. Points were awarded for appropriate article selection, neatness, quality of technical writing, and quality of the sections described previously. Additional
points were awarded for thoroughness of critique, critique rationale, and degree of comprehension displayed by the student. As the primary purpose of this assignment was to strengthen the students’ critical thinking skills, a large portion of the assignment points were dedicated to assessing this skill.

The structure of the assignment also allows for the assessment of more global course goals. Requiring a different article for each student emphasized individual in-depth research. The topic of the selected article was the student’s decision but was approved by the instructor to ensure the student has the background and skills to evaluate the work fairly and thoroughly and to guarantee the bounds of the article were appropriate, i.e. not too narrow or broad. This step prevented potential student failure due to poor article selection.

Developing life-long learning skills was also emphasized in each of the courses. This assignment emphasized this particular skill, as students were required to substantiate their claims by locating other resources related to the topic. To do this they had to research other authors, articles, and fields of study. Through their research, many students encountered contemporary issues related to their topic, as all referenced articles were to be recent and peer-reviewed.

**Observations**

**Benefits**

Most students appreciated the contribution their article made to the field whether they agreed with the results or not. Some students had criticisms of the research methodology and conclusions, and the students sometimes supported their case with outside research. The critiques showed student creativity in that students were able to suggest ways to make the research more understandable for someone new to the field and suggested ways to present results in a more organized manner.

This assignment allowed students with "outside" research interests the opportunity to research a topic relevant to the course without requiring the instructor to dedicate class-time to each student's topical interest. At times the topic of choice was applicable to another course or research project underway, such as senior design.

Due to the diversity of Human Factors and Biomechanics, it is possible to cover many different topics with this assignment. Although all students will not benefit from all chosen topics, each student will gain at least a little information on his or her topic. Due to this experience students were provided opportunities for discussion in class that normally would not occur. Through class discussions, students could see the relevance of what they are learning in class as applied in the "real world". Students have expressed that this encourages them. Anecdotal evidence suggests that students are skeptical regarding the application of material learned in-class to the "real world". This assignment does not relieve all skepticism, but does illustrate that some of the material is being used outside of the academic arena. An added benefit for instructors is the opportunity to learn about advances in their field, including special topic areas that were normally outside the scope of the instructors’ research interests.

**Drawbacks**

A major obstacle for the students was the difficult terminology. Students expressed frustration at the use of sophisticated terminology throughout the articles. This obstacle was anticipated by the instructors. The outside research component was initially required to encourage students to deal with unknown terminology and unfamiliar research methodology. However, students also expressed frustration with the additional research requirement. However, students who failed to do outside
research to either understand terminology or validate their observations typically performed poorly compared to students who did perform the additional research.

A major drawback for the instructor is the demand on time. Pre-approving topics, reading the articles prior to reading student critiques, and answering questions regarding the research articles requires a large time commitment. The assignment was also difficult to grade, as most engineering faculty are not used to evaluating qualitative assignments. A grading scheme shown in Table 1 was developed to assist the instructors in maintaining consistency and objectivity.

**Student Observations**

Based on student responses we concluded that the students were satisfied with the assignment and its relevance. According to one student: "...Reading current journal and newspaper articles helps us to become well-rounded students and I am thankful that you require them..."

**Lessons Learned**

After three semesters of implementation the authors have learned many things. A mini-review of an abstract or short article in class may improve the quality of the final critique. This would give the students an idea of what is expected regarding format and content. During this exercise, emphasis on the critique of the research article must be stressed, thus avoiding journal article critiques that are merely article summaries.

To assist the students in the development of a quality critique, the instructor may have drafts of certain sections due for homework. Instructors can also strongly encourage voluntary peer reviewing of their critique article by another classmate. Early submission may also be optional with the opportunity to make revisions based on instructor feedback prior to final submission. It is recommended that final submission require the inclusion of all previous versions, submissions, and homework related to the assignment to assist in grading the final version.

Due to the subjective nature of the assignment and the fact that all papers could not be graded at the same time, it was determined that a grading scheme was needed in order to keep the instructors consistent. Since the grading scheme has been in use for two semesters, the authors' feel distributing the grading scheme to students would be beneficial, as they would see the evaluation criteria and point distribution prior to submitting their critiques. The grading scheme may be altered as necessary to reflect the needs of each instructor or course.

It may be necessary to require students to use outside references, if this is important to the instructor. At first pass, the instructor assumed the students would use outside resources to verify their observations and to validate, or invalidate, the author's claims. While some students did this, the majority did not. Therefore, the instructor must make it very clear if this is a requirement.

Page limitations may be implemented for several reasons. First, it will require that the students focus on the important points in the paper. One of the authors required the critique to be a minimum of three pages, but a maximum of six pages. This author noticed an increased quality and clarity of writing. Another benefit of page limits is reduction in grading time.

Another valuable lesson was not to expect quality critiques from all students. There were instances where students just did not understand how to critically evaluate the article and therefore did not perform as well as expected. We suspect this will continue, but hope that providing more experience at earlier stages in their academic career (i.e. at the junior level), in addition to clearer performance
standards and examples, will improve the quality of the critiques and student understanding of what is required for a critique.

**Future Plans**

The authors intend to continue with this assignment in future courses, with a few modifications when necessary. For example, in the Spring 2002 junior level Human Factors course (ISE 311), a pre-selected article will be distributed for full critique. We consider this approach to be appropriate at the junior level considering their lack of experience and ability to "probe" research articles effectively. By pre-selecting, the instructor can limit the difficulty of the assignment. The senior level Advanced Biomechanics course will implement this assignment once again, but making some of the changes discussed in our "Lessons Learned" section. We feel this assignment may be used successfully at any level by controlling various aspects of the assignment.
Table 1: Grading Scheme for Journal Article Critiques

**CRITIQUE EVALUATION**

Student: _________________________________

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<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Score</th>
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</thead>
<tbody>
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<td>Results</td>
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<tr>
<td>Conclusion</td>
<td>15</td>
<td></td>
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<tr>
<td>References</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Does the reviewer understand the purpose of the paper?</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Thoroughness of critique, critique rationale</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Neatness; coherent, professional document, follows specifications</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Writing: grammar, readability, and spelling.</td>
<td>10</td>
<td></td>
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</tbody>
</table>

**SCORE**
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