ISSN: 1545-679X

Information Systems Education Journal

Volume 6, Number 65 http://isedj.org/6/65/ December 26, 2008

In this issue:

"WAC"ked: A Case Study Incorporating a Writing Process into an IS Class

Hirotoshi Takeda
Georgia State University
Atlanta, GA 30302 USA

Sara Crabtree
Texas A&M University - Commerce
Commerce, TX 75429 USA

Roy D. Johnson
University of Pretoria
Pretoria, 0001, Republic of South Africa

Abstract: This paper describes a pilot study designed to examine the effect of "Writing Across the Curriculum" on students' writing in the Information Systems discipline. Students enrolled in an introductory Computer Information Systems course in a large urban university in the southeastern United States were provided with a set of materials (Grading Rubric, Paper Format, Writer Review, Writing Rules, and Writing Example) to assist them in their writing of their research papers. Each student's research paper was assessed by three instructors (coders) independently using the same rubric to ensure consistent scoring. The initial results of this study indicate a 1/2 letter grade improvement in student's writing when using a re-write method over a single submission method. Assessment of student work showed as much as a full letter grade difference between the control and test groups by the end of the semester.

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Recommended Citation: Takeda, Crabtree, and Johnson (2008). "WAC"ked: A Case Study Incorporating a Writing Process into an IS Class. *Information Systems Education Journal, 6* (65). http://isedj.org/6/65/. ISSN: 1545-679X. (Preliminary version appears in *The Proceedings of ISECON 2006:* §4142. ISSN: 1542-7382.)

This issue is on the Internet at **http://isedj.org/6/65/**

The **Information Systems Education Journal** (ISEDJ) is a peer-reviewed academic journal published by the Education Special Interest Group (EDSIG) of the Association of Information Technology Professionals (AITP, Chicago, Illinois). • ISSN: 1545-679X. • First issue: 8 Sep 2003. • Title: Information Systems Education Journal. Variants: IS Education Journal; ISEDJ. • Physical format: online. • Publishing frequency: irregular; as each article is approved, it is published immediately and constitutes a complete separate issue of the current volume. • Single issue price: free. • Subscription address: subscribe@isedj.org. • Subscription price: free. • Electronic access: http://isedj.org/ • Contact person: Don Colton (editor@isedj.org)

EDSIG activities include the publication of ISEDJ, the organization and execution of the annual ISECON conference held each fall, the publication of the Journal of Information Systems Education (JISE), and the designation and honoring of an IS Educator of the Year. • The Foundation for Information Technology Education has been the key sponsor of ISECON over the years. • The Association for Information Technology Professionals (AITP) provides the corporate umbrella under which EDSIG operates.

"WAC"ked: A Case Study Incorporating a Writing Process into an IS Class

Hirotoshi Takeda
htakeda1@cis.gsu.edu
Computer Information Systems, Georgia State University
Atlanta, GA 30302-4015, USA
CREPA, Centre de Recherche en Management & Organisation
Université Paris Dauphine
Paris, 75775, France

Sara Crabtree
slcrabtr@garlandisd.net
Literature and Languages, Texas A&M University - Commerce
Commerce, Texas 75429, USA

Roy D. Johnson
Roy@UP.ac.za
Department of Informatics, University of Pretoria
Pretoria, 0001, Republic of South Africa

ABSTRACT

This paper describes a pilot study designed to examine the effect of "Writing Across the Curriculum" on students' writing in the Information Systems discipline. Students enrolled in an introductory Computer Information Systems course in a large urban university in the southeastern United States were provided with a set of materials (Grading Rubric, Paper Format, Writer Review, Writing Rules, and Writing Example) to assist them in their writing of their research papers. Each student's research paper was assessed by three instructors (coders) independently using the same rubric to ensure consistent scoring. The initial results of this study indicate a ½ letter grade improvement in student's writing when using a re-write method over a single submission method. Assessment of student work showed as much as a full letter grade difference between the control and test groups by the end of the semester.

Keywords: writing across the curriculum, introductory IS course, grading, rubric, curriculum design

1. INTRODUCTION

Success in ones personal and professional life is dependent on good communication skills. One of the most important of these communication skills is written communication. Those who demonstrate good writing skills, the ability to manipulate language to clearly convey meaning in a variety of settings and ways, tend to be more successful in their chosen professional fields (Forsyth, 2004; Stowers & Barker, 2003). As part of a quality university education, writing assignments are a central component of the collegial learning experience. Writing ability, however, does not develop during one or two classes. To become a good writer, communicator, and editor, students must practice the craft of writing multiple times in multiple ways (Bizzell, 1986). One way universities support learning to write is to include a "Writing Across the Curriculum"

(WAC) initiative that helps ensure that students are exposed to a variety of writing styles in multiple content fields (Cornell & Klooster, 1990). One area where writing has become increasingly important for communication and documentation is the area of Information Systems (IS) (Wahlstrom, 2002). Most universities require that students in IS demonstrate the ability to write in a professional manner (Eblen, 1983). Writing at the collegiate and professional levels is taught in a variety of universities to ensure diversity and quality (Maimon, 1982). Teaching writing does not fall on the shoulders of one discipline but across a variety of disciplines, many outside of traditional "writing" intensive classes. The writing skills required of university graduates are higher than that of the average high school graduate. Most students are required to demonstrate a collegiate level of writing before they graduate from an IS program (Owen & Young, 2005).

The businesses that hire IS graduates require a high level of writing ability (Canavor & Meirwitz, 2005; Dumaine, 2004; Forsyth, 2004; Gruber et al. 1999; Owen & Young, 2005; Stowers & Barker, 2003; Wahlstrom, 2002). Given this communication need by the business community for students to acquire a higher level of writing, many IS departments have incorporated writing assignments into the curriculum to help prepare students.

These researchers perceived a gap between the instructor's expectations and the student's abilities. The gap existed because instructors were expecting students to perform at a level they were not yet capable of achieving. Some practices that might hinder students from achieving expected performance are: One time assignments that did not allow for process writing, lack of a consistent grading rubric, and lack of good writing examples.

The purpose of this study is to examine the effect of WAC on IS students' writing skills. Specifically, the full writing process (plan, draft, develop, revise, edit) of WAC was incorporated by an introductory Computer Information System course in a large urban university in the southeastern United States. The tried-and-true method of detailed guidelines for writing and write-rewrite (multiple revisions) was used for students to complete their research papers. This methodology is a well researched area and is a widely accepted method in the writing discipline (Gillespie & Lerner, 2000; Flower & Hayes, 1991; Bizzell, 1986; Owen & Young, 2005; Perl, 1979; Sommers, 1980). Feedback between revisions is important and has to be carefully conducted during the writing process (Anson, Graham, Joliffe, Shapiro, & Smith, 1993; Connors & Glenn, 1999). According to the literature (Conners & Glenn, 1999; Anson et al., 1993), this study developed and employed a rubric based system to grade students' work so that scoring would be consistent among multiple coders.

2. BACKGROUND

WAC is a movement that gained acceptance in colleges and universities during the 1980's "as a response to a perceived deficiency in literacy among college students" (Purdue University Online Writing Lab, 2005). The main goal of the WAC is to give students the tools to synthesize, analyze, and apply course content in meaningful ways (Berthoff 1981; Wiley, Gleason, Wetherbee Phelps, 1996). However, "despite the thoughtful dedication of most teachers to their students' learning, few are trained in using current research in communication theory, learning theory, and writing theory to use these powerful connections between writing and learning effectively" (WAC History Online, 2005).

Because of the desire and need to create high quality writers in all courses through WAC, written components have been included in many courses (Greenberg, 1988; Jones & Comprone, 1992). However, the inclusion of the writing assignments has lead to a debate about how writing should be taught. Of the accepted methods, one that has proven successful is process writing. Lad Tobin (2001) states that, "writing occurs in series of steps and stages" (p. 7). The steps and stages Tobin refers to are the painful, yet productive, part of writing that is the process of writing itself. Manuals, textbooks, and the literature suggest that writing needs to be done as a process in order for it to be effective (Crowley, 1998; Dunbar-Odom, 2001; Gillespie and Learner, 2000; Harris, 1997). The process outlined in The Bedford Guide for College Writers (1993) suggests that "process oriented strategies" can be used in order to help students develop good writing skills. These process oriented strate-

gies are non-linear, meaning that steps can be repeated as often as needed in order to develop the best writing possible. The process suggested includes: plan, draft, development, revise, and edit. The circular nature of the process (Figure 1) allows students to draft, write, and revise multiple times before editing and finally submitting.

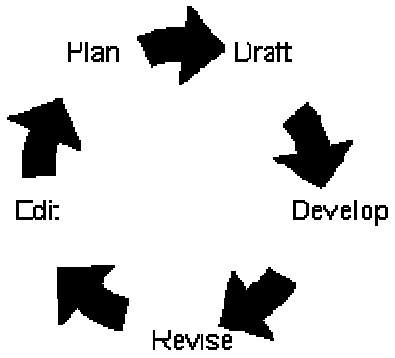

Figure 1: Write-Rewrite Process to Develop Good Writing

Assessment of writing assignments is another subject that has been well researched in academia. One fault with grading is that faculty are usually required to assign a single grade, letter or numerical, to the work of the student (Bloom, 1997; College of Composition and Communication, 1956; Greenberg, 1998; Lotto & Smith, 1979; McDonald, 1975). The mathematical and scientific fields are easier to assign a single grade or score since oftentimes there exists only one or a few possible 'correct' answers. This is true also in computer classes of the IS field because the correct code for a computer program segment is limited to insure the program complies and executes correctly. But in the case of writing, the goal is not a right or wrong answer, but a series of events or steps on which grading will occur. Forcing instructors to assign a grade to writing often leads to the question "What does it mean to say a student did 'B' work" (McDonald, 1975, p. 156).

Due to the imprecision of the writing process itself, the grading of writing has been criticized as being too vague (Greenberg, 1998). Some have proposed 'rules' or a 'system' to follow when grading (Lotto & Smith, 1979). Assessment standards must be applied to all papers in the same manner (Glenn, 1998). In order to be fair to each student, the instructor needs to let the students know, in advance, how they are going to be graded using a standard rubric or template (Chisholm, 1990). "Even subjective grading can be done in a fairly objective fashion if the standards are made known in advance" (Glenn, 1998, p. 788).

Assessment is most accurate when done without knowledge of the author's identity. One method to create anonymity is to code papers with a number and eliminate names (Lotto and Smith, 1979). Another method is to use staff grading, where grading is done by a group of instructors and a consensus is reached (College of Composition and Communication, 1956).

3. RESEARCH QUESTIONS

This research seeks to identify whether the use of the write-rewrite methodology, in conjunction with the use of writing support tools, leads to the success of the student on written IS projects. Success is defined by an increase in the quality of the final paper as demonstrated through the drafts of a writing assignment which has fulfilled the writing process mentioned previously in this study. Scores on the student submissions of the written assignments were identified as the measure of a students' success.

The research also tries to determine if the grading rubric adds to the reliability of assessment for a given assignment (Herrington, 1981). Reliability indicates a consensus in scores for a given assignment as scored by a panel of coders. Reliability offers a way to help control the variability between individual instructors' assessments. Assessment was measured in the variability of grading between the control group and the treatment group with the grading rubric. The research questions are as follows:

RQ#1: Do the students who use the writing process produce better products than those who do not use the process?

RQ#2: Is there more variability in the grading of a submission with the grading rubric compared to grading without the rubric?

RQ#3: Does the WAC initiative help students become more professional in their writing abilities?

4. METHODOLOGY

Research Design

This pilot study employed a quasi-experiment design. A convenient clustering sampling method was used so that the natural classes would not be disturbed. This study was conducted over two semesters (Spring and Fall of 2005). In this study, a total of 11 introductory IS classes were used. Four classes were in the treatment group, two classes received a partial treatment and five classes were in the control group. Students in the four full treatment groups received writing support tools and used the write-rewrite method when completing their research papers. The two partial treatment groups received either the support tools or the write-rewrite process, while students in the control group completed their research papers without writing support tools or using the write-rewrite method.

Study Sample

This study was conducted in the introductory computer information systems course required of all undergraduate business majors. The course, which covers a wide spectrum of topics in IS was administered at a large urban university in the southeastern United States. Eleven separate classes, with seven different instructors, were assessed in this study. Several instructors participated in both semesters. Students were neither required to take part in the study, nor required to do any additional work. The eleven classes were analyzed for demographic differences. There were no discernable or significant demographic differences between the eleven classes based on student major, year in the curriculum, age, ethnic background, or gender. The average student age was 25 for both groups and gender was evenly distributed for both groups.

Treatment

The treatment was a group research project which included a paper to be written by the teams (two or three students per group). The final paper was required to be six-pages with citations. In addition, teams were required to deliver a five-minute presentation on their selected topic.

All subjects in the full treatment group were given the support materials for the project. These materials were designed to allow students to understand the standards and expectations their project was to meet. These support materials included: Grading Rubric, Paper Format, Writer Review, Writing Rules, and Writing Example (Appendices A-E). The Grading Rubric assessed in detail how the paper would be graded and included four different categories: Content, Organization, Analysis/Reasoning Process, and Writing Conventions and Audience.

The treatment group was given a specific timeline in order to include the multiple submissions required by the process. At the end of the first week, the students were required to turn in a 'rough draft' of their paper and complete the Writer Review worksheet. The draft was a minimum of two pages, however, students were allowed to write the whole paper and use this as a means to receive feedback on their entire paper early in the writing project. Students were then given a bullet point assessment of their draft in two days. A small point incentive was given to insure submission of the draft. Grading of the draft was not based on content.

At the three-week mark the students were required to turn in their final paper. The grades for this paper were returned to the students within two days. For students who did poorly on the writing project, there was an option to turn in a reversion at week four to regain half of the deducted points.

Data Collection and Analysis

Three researchers coded the data and provided feedback and scores promptly for the treatment groups. The researchers met three times during the semester to grade each iteration of the project. The scoring and feedback were returned and used by all the instructors in the treatment group. The full treatment group had an N of 45 teams, the group with draft only had an N of 15 teams, and the group with materials only had an N of 14 teams. The control group did not receive any feedback from the research team because they only submitted a final paper. This high-stakes writing yielded an N of 65 teams, for a total N of 137 teams when combined with the treatment groups (Table 1).

Each paper in the treatment and control groups was individually assessed by all three researchers. The submissions were coded with numbers and the names were blacked

out in order to prevent any grader bias due to familiarity with the student, their ethnicity, or gender. The researchers were also blind to the group (control or treatment) affiliation of the papers. First the researchers individually graded papers according to the assignment and the grading rubric. Then there was a meeting where the researchers compared their individual grading. Where there were differences in opinion, a discussion ensued to reach a consensus on the grade. Once assessment was completed, the inter-rater reliability was tested. Ten papers were chosen at random and re-graded using the same process of the researchers individually grading, meeting, and coming to a consensus. The re-grades were all within a single letter grade of the original grading.

5. RESULTS

All papers were assessed based on the final submission. The researchers wanted to ensure students were allowed to fully develop their papers using the writing methodology. Grading was traditional were A corresponds to 90% to 100%, B corresponds to 80% to 89.99%, and so forth. Overall the average grade was 85.16% (Table 1). The control group had an average of 82.99%, while the treatment group had an average of 89.12%. The difference was 6.13% or about half a letter grade. One class in the treatment group did exceptionally well as the average was 95.11%. This class represented a 14.71% difference between itself and the lowest scoring control group. As might be expected, the partial control groups using draft only or materials only had averages falling in between the control and the full treatment groups. This suggests that the WAC process can be incrementally applied with incremental improvements. The instructor in the control classes 4 and 5 submitted data to the researchers combined, thus there was no way for the researchers to distinguish students between the two classes.

It should be noted that this research study focused on the final product or the final paper submission. The instructors may have added points for students that were in a smaller group, or taken points away due to lateness. These differences were not controlled for in this research and based on self reporting by instructors, these differences raised the average grades in the control group but are not reflected in this study.

	Semester	Teams (N)	Average Score
Control 1	Spring	16	86.6
Control 2	Spring	15	81.5
Control 3	Fall	10	80.4
Control 4, 5	Fall	22	82.5
Control Total	**-**	**63**	**83.0**
Full Treatment 1	Spring	16	84.7
Full Treatment 2	Spring	14	95.1
Full Treatment 3	Fall	5	89.4
Full Treatment 4	Fall	10	88.2
Full Treatment Total	**-**	**45**	**89.2**
Draft Only	Fall	15	82.8
Materials Only	Fall	14	84.4
Overall	**-**	**137**	**85.2**

Table 1: Scoring with Grading Rubric for Treatment and Control Groups

This research attempted to tackle a seemingly old problem: how does WAC help students become better writers. While many other disciplines have been dealing with this subject for a long time, the relatively new IS field is still at the early stage of incorporating writing into their curriculum. IS professors have realized the importance of writing in their students careers, but incorporating the lengthy process is problematic. This research suggests one method for incorporating a writing process into the IS curriculum.

The first research question asked: Do the students who use the writing process produce better products than those who do not use the process? The data collected in this study supports the concept that a writing

process will improve writing ability and quality, which results in an increase in grades. This claim is supported through the development of ideas present in the papers submitted using the process. Of course, having feedback helps, but students were on their own to revise the drafts in order to fulfill the assignments needs.

The second research question asked: Is there more variability in the grading of a submission with the grading rubric compared to grading without the rubric? There was an increased variability in the grading of the papers for the control groups by the instructors, compared to the coders of this research. The researchers believe the rubric aided in providing consistency in the assessment process by providing a set standard for evaluation.

The third and final research question asked: Does the WAC initiative help students become more professional in their writing abilities? This study has presented data supporting the position that WAC assists students in becoming better writers. Being a good writer means having the ability to manipulate words and language in order to communicate a given set of ideas and products. To this end, the WAC initiative encouraged students to understand that Information Systems is a field in which the writing process is of value. By encouraging students to use a writing process now, the belief of this research team is that by the time these students graduate and enter the business world, they will be equipped with the written communication skills they need to perform their job.

6. DISCUSSION

Due to the exploratory nature of the research there are several possible weaknesses to this study. First, the treatment may not have been the same for all the sessions within a group. As seen from the discrepancy between two of the sessions in the treatment group, this may have been the result of a difference in the way the material was presented. One treatment group realized an average of 95.11% while the other treatment group averaged 84.66%. The WAC process implementation may have improved from the spring to the fall semester as the variability between the full treatment groups was small (1.2%) in the fall. The control group also saw some difference as one group achieved an 86.6% average versus an 80.4% average.

Second, there was little control over the grades assigned to the students by instructors, thus possibly causing a problem in achievement by the students in the final paper. All students in the treatment group received feedback on the rough draft. However, individual instructors used their own discretion to assign final grades to the students' projects. Those final grades could have reflected a number of issues that were not controlled for by the researchers (i.e., bonus points, cheating deductions, additional time or penalties for late submission) The instructors were free to take the researchers suggested assessment or to make the instructors own assessment. Instructors own assessments were not asked for due to possible integrity issues due to differences in grading by the researchers and the instructors. So the researchers also note that students in the control group may have received an increase in the grades awarded over the researchers suggested assessment. If students received a higher grade than the researchers suggested assessment there may be a degradation in the incentive to rewrite the paper.

7. FUTURE RESEARCH

The writing process presented in this paper is one way to incorporate writing into the IS curriculum. There are multiple writing models that would provide students with necessary writing instruction. The researchers are currently exploring some of the other models, such as journals, peer-evaluation, and writing portfolios (Koprowski, 1997). Incorporating and evaluating these methods in an IS classroom would be methodologies worth studying by other IS researchers.

The study has also produced a discrepancy in the way the material was presented to the students in the treatment groups. There was no built in control to allow a singular presentation of the material, and due to the fact that the data were taken in a real class setting, there are difficulties related to consistency of the treatment and in the treatment over different class sections of the same course.

An area for expansion of this study is the incorporation of the re-write process into other higher level writing classes in the IS curriculum. The problem with targeting higher level classes is that the number of student enrolled are significantly smaller than in an entry level class designed for the whole business school.

8. CONCLUSION

The results of this study provide a method to identify, assess, and incorporate writing in the Information Systems classroom. The Writing Across the Curriculum initiative is an accepted model that is slowly finding a home in the IS field. The incorporation of the write-rewrite method along with the standardized assessment rubric has helped to reconfirm that writing is best done in a classroom when there is a consistent approach for teaching. The study supports this ascertation by the increase of at least ½ a letter grade using the write-rewrite method as opposed to a high stakes writing model. The researchers are confidant that applying this model in the IS classroom would be valuable.

The authors would like to thank the US Department of Education for the GAANN grant that aided in the funding for this paper.

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APPENDIX A (GRADING RUBRIC)

Case 2: Grading Rubric

Content	Analysis	Organization	Mechanics	Resulting Quality
• Identifies Specific Topic (1-2 Words). • Stays on topic and provides relevant details. • Gives thorough information about all subjects discussed.	• Reader will understand why topic is important. • Supports all claims with details. • Explains all confusing points, terms, numbers, etc. • Logical analysis	• The writing develops in a very ordered way. • Many transitions moving between points or subjects. • The writing draws to a logical end.	• The writing has few, to no, mechanical errors. • The word choice is appropriate for level and subject. • All formatting directions followed.	Outstanding
• Identifies Specific Topic (Several Words). • Stays on topic and provides mostly relevant details. • Gives some information about all subjects discussed, but could give more information.	• Reader will sense why topic is important. • Mostly supports claims with details. • Explains some confusing points, terms, numbers, etc. • Logical analysis.	• The writing develops in an ordered way. • Uses transitions to move between points or subjects. • May have some un-organization, but very little distraction to the reader • The writing draws mostly to a logical end.	• The writing has a few mechanical errors. • The word choice is mostly appropriate for level and subject. • Most directions for formatting have been followed.	Exceeding Expectations
• Specific topic implied or stated, though may be confusing. • May deviate from topic. • Some non-relevant information is given.	• Reader may not totally understand why the topic is important. • Supports some claims with details. • Leaves confusing points terms, numbers, etc. • Some illogical analysis	• The writing develops in a mostly ordered way. • Some transitions used to move between subjects or points. • The writing tries to draw to a logical end.	• Mechanical errors were distracting to reader. • Some word choice may not be entirely appropriate. • Errors in formatting.	Meeting Expectations
• Topic is not clear, through statement or implication. • Topic is not supported by enough detail. • Much non-relevant information.	• Reader may not know why topic is important. • Claims are not supported well. • Leaves confusion. • Analysis is illogical most of the time.	• The writing does not develop coherently. • A few transitions used, paper somewhat difficult to read. • The writing does not draw to a logical end.	• Mechanical errors were a serious distraction to the reader. • Word choice was mostly inappropriate. • Formatting directions were not followed.	Below Expectations
• Reader does not know what the topic is. • Little to no discussion about the topic. • Mostly non-relevant information.	• Reader does not know why topic is important. • Claims are not supported. • Writing does not attempt to analyze the importance of the topic. • Analysis is illogical.	• The writing not coherent. • The paper is difficult to read. • The writing does not draw to an end.	• Mechanical errors were seriously distracting to reader. • Word choice not appropriate. • Formatting directions were not followed.	Below Standard

APPENDIX B (PAPER FORMAT)
Case 2: Format

1. **Page Setup**: Word process, left justify, double-space, 1" margins each side (top, right, bottom, and left), Times New Roman, 12-point, portrait, 8.5" X 11".
2. **Cover Page**: None.
3. **Heading**: Single space, upper left, first page (**NOT** in the header) teammate names, professor's name, course number, section, and date. Example:
   Bill Shakespeare & Annie Landers
   Dr. Johnson
   CIS 2010, 10751
   April 16, 2005
4. **Pagination**: Author's last names & page number in header, right justified.
5. **Title**: Be original, but do **NOT** underline, italicize, bold, or use all caps.
6. **Format**: **Paragraph, Indentation, Left: .5"** (no blank lines between paragraphs.
7. **References (reformat paragraphs)**: **MLA format**, end notes, separate page (last page but, **NOT** an attachment).
8. **Length**: Minimum four (4) pages plus one (1) reference page.

APPENDIX C (WRITER REVIEW)
Case 2 Writer Review

1. What is the topic of your paper (1 or 2 words)?
2. What is the thesis statement or purpose of your paper (complete sentence)?
3. What details do you provide to help support your thesis?
4. What sources did you use?
5. What words do you use to transition between your paragraphs or ideas?
6. What examples do you provide to help explain your points?
7. How do you "sell" your argument? Why should the reader believe you?
8. What did you learn by doing this research?
9. What should the reader learn from reading your paper?
10. What area of your paper do you think needs the most work? Why?
11. What area of your paper do you think is really good? Why?
12. Did you check the:
    grammar, spelling, punctuation, word choice, citations, and format requirements?
    _____,_____,_____,_____,_____,_____

APPENDIX D (WRITING RULES)
Case 2: Writing Rules

In order to strengthen your writing for academic purposes, here are a few general writing rules. These writing rules pertain to certain grammatical and rhetorical choices that would be otherwise ambiguous. All of these writing rules will help you in your academic career and help you to become a stronger writer.

1. Do not use **contractions** in your academic writing. They are perfectly acceptable in your speech and non-academic writing, but they are a short cut and not formal. Formal writing is a requirement for academic writing. (A contraction is a word like: don't, can't, shouldn't, wouldn't, I'm, we're, she's, he's, it's, etc. . .)
   Example: "I don't believe he's on the phone, because it's time to go."
   Correction: "I do not believe he is on the phone, because it is time to go."

2. Place a **comma** before the *and* that precedes the last item in a series.
   Example: "I like oranges, apples and bananas."
   Correction: "I like oranges, apples, and bananas."

3. Do not use the words "**a lot**" unless you are referring to an actual lot (i.e. a parking lot)
   Example: "I have a lot of dogs."
   (Meaning: You have a lot that is full of dogs.)
   Correction: "I have 12 dogs" or "I have many dogs."

4. Do not use **slang** or **colloquialisms** in your writing.
   Example: "This class is cool" or "Life sucks."
   Correction: "This class is interesting" or "My life has its limitations."

5. Avoid **generalities** and **clichés** in your writing. **Be specific!**
   Example: "Everyone loves baseball" is a generality. (Can this be proved?)
   Correction: "Baseball is a popular sport based on current ballpark attendance."
   Or
   Example: "Everyone is entitled to their own opinion" is a cliché. (So?)
   Correction: "One opinion on this issue, that I support, is …."

6. If you are going to use **large words**, please make sure you really know what those words mean. If you are using big words to make yourself sound smart, you should make sure you use them correctly or you are defeating the purpose and will not sound intelligent.
   Example: "E-commerce promotes disintermediation."
   Correction: "Electronic commerce eliminates the middleman."

APPENDIX E (SHORTENED WRITING EXAMPLE, PAGE 1 OF 8 SHOWN)

Bill Shakespeare and Annie Landers
Dr. Phil
IS 100
April 16, 2005

Notice the heading is on the left margin.

The Paper Title is centered, not in bold, italics, or all caps. There is not an extra line between the title and the text.

Optical Networking: A

Optical networking is the transmission of data by sending laser light through filaments of glass fiber. To better understand how the optical network operates, think about how Morse code was used aboard ships during World War II. When the ship was in trouble, they used a shutter spotlight to send signals in Morse code. The receiving ship would then flash the messages along until it reached the appropriate destination where help could be provided to the ship in danger. This process of sending messages is an example of digital optical transmission.

Identifies specific topic and explains why the topic is important. Notice the explanation is not one sentence, but a few paragraphs. This is acceptable, but make sure every paragraph adds to your discussion of the topic.

These paragraphs show how effective examples can be used. Transition in Paragraph 2 is good.

The method aforementioned is how an optical network operates, only the technology is different. Instead of using a spotlight the network uses a laser. The Morse code is replaced with a transmission protocol. Switching circuitry takes the place of the shutter spotlight. The air between the ships is now glass fiber, and the receiving ship in the middle becomes an optical repeater.