ISSN: 1545-679X

Information Systems Education Journal

Volume 1, Number 38 http://isedj.org/1/38/ December 27, 2003

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Recommended Citation: Pomykalski (2003). Critical Thinking through Writing in Information Systems Courses. *Information Systems Education Journal, 1* (38). http://isedj.org/1/38/. ISSN: 1545-679X. (Also appears in *The Proceedings of ISECON 2003:* §3412. ISSN: 1542-7382.)

This issue is on the Internet at **http://isedj.org/1/38/**

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: 2003. • Title: Information Systems Education Journal. Variant titles: IS Education Journal; IS Ed 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)

The Information Systems Education Conference (ISECON) solicits and presents each year papers on topics of interest to IS Educators. Peer-reviewed papers are submitted to this journal.

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Critical Thinking through Writing in Information Systems Courses

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Abstract

One of the guiding assumptions of the IS2002 Model Curriculum is that all Information Systems professionals "must have good interpersonal communication and team skills"; namely writing skills. In this paper, the author addresses one way of giving information systems students practice with writing skills. The Non-Technology Report is a writing/research paper that helps the student develop both their writing skills as well as critical thinking skills in finding and evaluating information.

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1. INTRODUCTION

The education and development of information systems (IS) professionals, especially through an undergraduate business program, is a difficult task. IS professionals today are expected to have a wide range of information technology based skills (Gorgone et al., 2002). In addition to the technology skills however, the IS professional must also possess critical thinking skills, especially writing skills.

This paper address the development of critical thinking skills by discussing the use of various writing assignments within IS courses. Particular attention is given to a research/writing assignment known as the non-technology report (NTR). The author's objectives, outcomes and experience with these NTR assignments are highlighted. Non-technology reports are a research/writing assignment given to students on various IT-related topics that are non-technological extensions (e.g., managerial or organizational) of specific IS concepts. For example, students research the impact, both financial and operational, of data quality on the managerial decision-making process.

In the next section, the importance of writing for students and professionals, especially business-related students and professionals is discussed. In addition, we discuss the Susquehanna University standards for courses that are to incorporate writing within the course; these courses are called *writing-intensive* courses.

2. WRITING SKILLS FOR BUSINESS AND IS PROFESSIONALS

Writing has been seen as an essential part of all levels of education across all disciplines. Starting with the development of "writing across the curriculum" programs in the 1970's to today when writing is "not a frill for the few, but an essential skill for the many." (Colleges, 2003) Writing is one of the most important life skills, "it's a skill that can help you communicate your ideas and persuade others" (Goldberg, 1995). Even the IS2002 Model Curriculum, calls out both critical thinking and writing as skills

that need to be integrated into IS courses because they are essential for all IS professionals (Gorgone et al., 2002).

Business writing skills, which differ in the types and style of writing, are also essential for any undergraduate business program to work to develop. Writing skills are as important in business as other management skill (Tarrant, 1991). Business professionals are called on to write memos, e-mails, letters, reports, proposals, presentations, etc. (Zobel, 1997, Roman and Raphaelson, 2000, Alexander and Stevens, 2002). IS professionals face the additional burden of creating statements of work, requirements, documentation, user and training manuals, etc. (Valacich et al., 2004, Zobel, 1997, Alexander and Stevens, 2002). With all this writing expected of today's business and IS professionals it is incumbent upon business schools, including IS faculty, to provide students the opportunity to hone their writing skills.

At Susquehanna University, a private liberal arts undergraduate institution, an additional requirement is made upon the students in the form of "writing-intensive" courses. Each Susquehanna University student must take at least 8 hours of course work (out of a total of 130 credits for graduation) that is considered writing-intensive. For a course designated as "writing-intensive", the following standards must be met:

1) Require writing assignments amounting to approximately ten (10) typed pages or 3000 words. Examples: research/term papers, essay-length writing done in or out of class; including exams, or various written reports; including lab reports. These assignments must be at least one page.
2) Writing requirements must include either multiple assignments or, if only one paper, rewriting.
3) Written assignments must be evaluated and graded on writing skills (organization, clarity, grammar) as well as content.
4) Written assignments describe above must count for at least 25% of the course grade.

The challenge IS faculty face is having the time, among the many technical topics that need to be covered (Gorgone et al., 2002), to have students develop critical thinking and writing skills. In order to give the students practice and to meet the university writing-intensive standards the NTR assignment was created. In the next section, the NTR assignment is introduced with discussion on the purpose and objectives of the NTR as well as a grading rubric that is used to judge the quality of the student's writing efforts.

3. NON-TECHNOLOGY REPORTS (NTR)

What is a Non-Technology Report (NTR)?

The outcome of the non-technology report is simply a short three page summary of three to four "articles" on a particular non-technology topic dealing with information systems. For example, in the Management Support Systems course (which is a senior level course dealing with strategic information and decision support systems and managerial decision-making) students are asked to find articles that relate to the topic of data quality and its impact on managerial decision-making in organizations.

Currently, the NTR focuses on non-technology issues (e.g., managerial or organizational aspects relating to IS). The major reason for this focus is threefold:

1) Demonstrate that Information Systems is not just a technology field.
2) Promote "systems thinking" by showing students that IS decisions must coincide with managerial decision-making.
3) Integrate IS with other business areas.

Business students have a myopic view of IS as just "technology". By introducing the non-technological aspects of IS development through these research assignments, it (hopefully) gives students a better sense of IS in business.

The major part of the assignment, however, is getting the students to find, evaluate and summarize three to four "quality" articles that are closely related to one another. The real critical thinking skill in the NTR assignment is doing the actual research and producing a summary that meets the guidelines of the assignment.

The author provides for the students a list of appropriate sources (Internet and Intranet links) which are a combination of on-line business-oriented journal articles (selected from the Susquehanna University library of on-line databases—InfoTrac OneFile and Wilson Select) and selected on-line technical magazines such as Intelligent Enterprise, CIO, and Computer World. The students are shown during an early class meeting how to search through these sources to find appropriate articles for their NTR. Each NTR assignment explains the general topic, such as data quality, and the author will have already provided an introduction to the topic within the lectures in class.

The student then must be able to develop a focus for their NTR through knowledge of the topic area and evaluation of the written materials found in their search. These critical thinking skills of close reading and evaluation of the content of written material, develops in the student the lifelong learning skills necessary to advance in a business environment.

Purpose and Objectives of the NTR

The non-technology report concept has two primary purposes beyond the practice of writing. First, to give students a new lifelong learning, critical thinking skill; doing outside research in a technical field. Second, to provide students an opportunity to enhance their critical reading, evaluation, and analysis skills of IS-related literature. A positive side-effect of the use of the NTR assignments has also been increased in-class discussion opportunities.

Writing papers (even short papers) that involve finding, evaluating, and summarizing articles, and then subsequently citing the articles is a difficult task for any college student (Bean, 1996). Bean (Bean, 1996) cites eight kinds of skills students must learn in doing research papers (of any length). Of these eight skills, four of them are practiced through the NTR assignment. These skills include (Bean, 1996):

1) how to find sources,
2) how to work sources into the paper,
3) how to manage the sources, and finally,
4) how to cite the sources.

As mentioned in the previous section, the author provides the students with a research topic for exploration. The students are given a list of available, "quality' sources to make selections from; the selection of the particular articles is a matter of using a search engine. The development of a summary that is integrated and not just a simple summary of each individual article forces the students to try to weave the multiple sources into a coherent paper. Managing sources ties in well with topical integration, in that students need to pick out only the parts of the article that are deemed relevant to the particular topic. Finally, citations are dealt with through a particular grading criterion (see below). The students are asked to follow the APA style manual which is also provided to them by the author.

By performing outside research and asking them to produce smaller summaries, the students gain experience and enhance the above skills, therefore giving them confidence to engage in research tasks on a larger scale.

The most important question that student's ask is: what are you looking for? In answer to that particular question a grading rubric for the evaluation of the writing assignments has been developed. Many different grading rubrics exist (McKeachie, 1986, Davis, 1993, Morris and Tucker, 1985), the author's rubric is a combination of past experience with writing assignments and the ones listed in the literature (McKeachie, 1986, Davis, 1993, Morris and Tucker, 1985).

Writing/Grading Rubric

Within the rubric, content and format/style are equally weighted. However, since these assignments constitute a large percentage of the student's final grade in the course, the author is careful to delineate more fully the grading of these two particular areas. Grading rubrics (Table 1) give each individual student more control over their assignment (McKeachie, 1986).

Grading Criteria	Percentage	Comments
Completeness	30%	Content is 50%
Correctness	20%	
Focus	10%	Format and style is 50%
Organization, Structure & Flow	15%	
References	10%	
Grammar/Spelling	15%	

Table 1: Grading Criteria

There are two important parts to the content criteria: completeness and correctness. Completeness deals primarily with whether or not the student covered the topic area they selected to a sufficient level of detail. The students are instructed that if the reader is left to ask the question: "Is that it?" then they have not fully covered the topic area. Correctness is graded based on two things: (1) did the students use terms and concepts correctly and (2) did the student use the terms and concepts in the correct context.

In business, many readers often decide within the first two or three sentences whether to continue reading (Blake and Bly, 1991, Roman and Raphaelson, 2000). The focus of writing criterion forces students to state upfront their main idea or argument. The students are given fairly wide latitude in choosing a specific topic within the broader NTR topic. The student must be able to tell the reader the particular issue or problem they are dealing with and how it relates to the larger question. The focus criterion deals with whether or not the student has stated clearly their main idea or argument. Additionally, this criterion is used to judge whether or not the students have continued to stay on topic.

One of the most important stipulations given to the students for the development of a quality (i.e., high grade) NTR is that the final written assignment be a focused, integrated, and well organized summary of their research findings; it should not be three single summaries (paragraphs) of each individual article. It is therefore critical that the students find articles that are "related" to one another. It is stressed that their research efforts (critical thinking) should take more time than the actual writing.

The area covered by the organization, structure and flow criterion seems to be the most challenging to the students. This is the criterion where students tend to lose the most points. In addition, of all of the categories within the grading rubric, this is the one area that has increased in value (over time) in an attempt to get students to focus more on their article selection process.

The flow of the written assignment is an important element to its organization. Does the paper flow from the main focus of the article? Does the paper have a clear beginning, middle and conclusion? Does everything in the article support the main idea? Do transitions between the sentences, paragraphs, and sections clearly show how the parts are connected? The organization, structure and flow criterion signify that clarity and conciseness in business writing are valued more highly than verbose and pointless prose.

Being able to cite outside sources effectively and create an appropriate reference list, according to a standard format (usually APA style), is a skill that needs to be developed in all writers. Therefore the references criterion judges how well the students have done in citing sources. In an era of increased plagiarism the author is very diligent in impressing on the students the need to cite the source of material that is not original. The author is not (nor can he be) familiar with every written source that the students choose, however, it is impressed upon the students that academic dishonesty violations will be treated severely and attempts to plagiarize material will lower their grade significantly. Another way this criterion is used is in trying to get students to cite material that runs contrary to material presented in the classroom setting. In other words, if the students find an article that has a contrary opinion or point of view to what has been said in class, and then the student must cite this source or risk losing points.

The knowledge of basic spelling and grammar rules is essential for succeeding in any form of writing (Blake and Bly, 1991). Each student must take the time to review their written work before submitting it in order to avoid "loud" grammar and spelling mistakes. Minor and infrequent grammar mistakes are usually overlooked (especially in the early assignments); however, frequent and/or obvious grammar and spelling mistakes have a large negative effect on the student's final grade.

In the next section, each of the course in which the NTR assignments are used is described. The particular topic areas for each of these courses are described as well as new potential topic areas. The author believes that changing topic areas is a means for keeping the particular courses fresh and current. The course descriptions as well as

the other types of writing of assignments are also discussed.

4. COURSE DESCRIPTIONS AND WRITING ASSIGNMENTS

The author teaches four different courses in which various types of writing assignments, including the NTR, are used. Three of these four courses are listed as "writing-intensive" courses and therefore require more writing. However, the author believes that writing is such an important skill that students are required to complete written assignments in each course. Each of the four courses is discussed individually. The discussion focuses on the use and topics for the NTR assignments, but additional writing assignments are also described.

Management Support Systems

Management Support Systems is a senior level IS course. Management Support Systems, a core course for all business students, focuses on the use of IS, and specifically Decision Support Systems, to aid managerial decision-making. Within this course three different types of writing assignments are used: case studies, the NTR, and a larger research paper.

Two case studies are assigned in the course and the students are given the option of preparing these case studies either individually or in groups of two. The case studies consist of a two to three page writing assignment that describes the case and the underlying issues while addressing some basic technical and non-technical issues described within the case.

The NTR was begun in the Management Support Systems course to make students (especially seniors) aware of the non-technology issues that are dealt with concerning information systems development and use. The course begins by distinguishing between functional and strategic IS (SIS). The first NTR assignment is structured around the use of SIS in industry and government. The students are asked to find examples of how enterprises use SIS to gain a particular competitive advantage and the rationale for their technology choices. They are to find and report on an enterprise and its use of a SIS to solve a particular problem.

This particular NTR has a secondary purpose. As part of the final course requirements for Management Support Systems the students develop a 7 to 9 page research paper that looks at a particular company's use of a Decision Support Systems to aid some form of managerial decision-making. In this research paper, they must present a corporate (or agency) background, a summary of the problem faced by the organization, an explanation as to the type (or types) of Decision Support Systems that were used to solve the problem and the results. In addition, the students are asked to try to extend their thinking by speculating on how the firm might use this Decision Support System to further enhance managerial decision-making within the enterprise.

One to two other NTR assignments are also required of the students. Some of the topics that have been used in the past are: data quality in regard to managerial decision-making, the benefits and/or problems in integrating of data sources, the benefits and costs of end-user training for new systems, and the ethics of data handling and storage by enterprises. Each of these NTR assignments has given the students the opportunity to broaden their view of a particular subject area in light of its impact on managerial decision-making. The main point is to show students that IS design and development is not just about technology but important non-technological issues are often intertwined. Another important outcome of these reports is that is also leads to in-class discussion opportunities that enhance the overall learning experience.

Systems Analysis and Design

The systems analysis and design material within the Susquehanna University business school curriculum is taught as a two part course sequence. The first course is required of all business majors and covers the systems planning, analysis and design phases of the software development lifecycle (SDLC). The second course, entitled Systems Development, continues the work from the systems analysis and design course from the systems design phase through implementation and operations. Both of these courses are listed as University writing-intensive courses.

The introductory systems analysis and design course has two primary types of writing assignments. The first are brief one to two page memos that describe an activity within the systems planning, analysis or design phase of the SDLC. The second type of assignment is the non-technology reports which will be described below.

The activity memos are meant to have the students explain the modeling process and the results of their modeling efforts. In the activity memos the student attempts to describe to a potential user or client the systems analyst's (their own) view of the current system. The memo writing provides the student practice in communicating their systems thinking using a primary business format.

These memos are part of assignments that deal with: determining the economic feasibility of a project, the development of an Entity-Relationship Diagram (ERD), the development of a context diagram, and finally, with the development of a database schema in which the final normalized table structure is presented. In these memos, the students are asked to explain the development of the model and the key elements contained in the model. The memos are produced both individually on a simple application and then repeated in a group activity on a larger more complicated problem. The audience for these memos is the "non-technical" end-user/client community.

Two NTR assignments are given as part of this course. In the past, the NTR assignments have covered a number of different topic areas. One of the most important NTR topics deals with the use of return on investment (ROI) calculations to determine project feasibility. The students are asked to focus on how companies quantify and incorporate intangible benefits into project feasibility determinations. Other NTR topics have dealt with:

- the use of project management tools to aid database development,
- the pros/cons of various requirements gathering methods,
- the pros/cons of user involvement in the analysis and design phases of the SDLC, and
- the ethics of data management by enterprises.

The second course in the systems analysis and design sequence is taken as part of the Information Systems major. Within this course, students are again asked to write activity memos around design and implementation activities. In addition, the students are required (as a group effort) to write system development documentation (similar to what they would write in industry). This documentation, which usually entails about seven to 12 pages, documents the design and implementation decisions that made during their project development. Their work is based on their previous development efforts in the first course in the sequence.

Again, two NTR assignments are part of the course work. NTR subjects in this course deal with:

- the pros/cons of outsourcing,
- the pros/cons of user involvement in the design and implementation phases of the SDLC,
- the benefits and costs of end-user training for new systems,
- common mistakes made in the development of the user interface, and
- common reasons for system implementation failure.

Simulation Models

A junior level IS major course focuses on the use and development of simulation models to analyze business process problems. The students begin this course be reviewing a business scenario and a corresponding simulation model. They are asked to run the model, analyze the results of the simulation and suggest solutions to the business process problem. In later assignments, the students are again given business scenarios but begin to build various pieces of the simulation model as well as performing the analysis.

The writing in this course is focused on the explanation and analysis of the model and the solution to the corresponding business problem. At this time, no NTR assignments are being required. This is the only course the author teaches that is not "writing-intensive".

5. CONCLUSIONS AND FUTURE WORK

Writing is also "the way students connect the dots in their knowledge" (Colleges, 2003). The focus of the NTR on non-technology issues allows students to see that there is a correlation between the technology of IS and the management of the technology. By using issues such as data quality, user training, and information ethics the students can see the role that is played by managerial issues in the successful implementation of the information system.

The College Board also concluded that writing should be increased across the student's academic experience (from elementary school through college) and the inclusion of writing assignments in technology areas should be increased.

The IS2002 Model Curriculum "is designed to produce graduates equipped to function in entry level information systems positions with a strong basis for continued career growth" (Gorgone et al., 2002). An important part of that basis is the development of critical thinking skills, especially writing skills.

The author believes that the inclusion of the NTR has been an effective means for getting the students to develop these career skills. The inclusion of writing assignments, like the non-technology report, allows students to develop important life skills that they can then use in their career.

The NTR assignments will continue to be an important tool in helping students develop much need career skills. In the future, more NTR assignments need to be developed so that a library of NTR assignments can then be used.

In addition, NTR assignments need to be developed for the Simulation Models course. Possible topic areas could include:

- the gathering of empirical data in order to form proper distributions for arrival, service, and failure times,
- the pros/cons of using animation as a communication tool with end-users/clients, and
- the importance of understanding model assumptions in the use of a model for solving other similar problems.

It is the author's hope that other IS faculty (and even some business faculty) will use the NTR assignments as well and share their experiences, applications, and examples with others.

6. ACKNOWLEDGEMENTS

The author would like to acknowledge the comments of the three referees for their important comments.

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