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The Application of Writing Across the Curriculum (WAC) Techniques in a Systems Analysis & Design Flipped Classroom

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Abstract

To more effectively meet the expectations of industry for entry-level IT employees, a case is made for the inclusion of writing throughout the Computer Information Systems (CIS) curriculum. *Writing Across the Curriculum (WAC)* principles are explained, and it is opined that both Writing to Learn (WTL) and Writing in the Disciplines (WID) pedagogies are desirable for inclusion as part of the delivery of the CIS curriculum. Examples of both WTL and WID are provided from the author's Systems Analysis & Design (SAD) course. It is concluded that the use of WTL and WID techniques in the flipped SAD course has both (1) increase student engagement both in and out of the classroom, and (2) improved student writing and learning.

Keywords: Student Learning, Student Engagement, Employer Expectations, Writing Across the Curriculum, Writing in the Discipline, Writing to Learn.

1. WRITING IN THE CIS CURRICULUM?

We live in an era of sound bites and 140 character messages, but good writing is still necessary for success in today's business environment. Paying attention to grammar, spelling and punctuation, along with good word choice and the use of a consistent style, is important because bad writing can have a wide range of negative career and personal consequences.

As information systems professionals we use writing daily for a variety of purposes including to communicate information (memos, email, etc.), to clarify our thinking (when we work through an idea or problem in writing), to learn new concepts and information (taking notes on reading and research topics), and to write formal reports (requirements definition, feasibility study, systems proposals, etc.).

As aspiring professionals our students need practice to be able to use writing effectively to meet these same goals. One or two writing classes taken in the freshman year simply cannot provide enough practice to increase the quality of our students thinking and writing. As one response to students' lack of writing practice throughout the university curriculum, *Writing Across the Curriculum* (WAC) programs began to emerge in the early 1980s. While the structure of individual WAC programs exhibit some degree of variation, the philosophies underlying these programs generally agree on certain basic principles: (1) writing is the responsibility of the entire academic community; (2) writing must be integrated across departmental boundaries; (3) writing must be continuous during all four years of undergraduate education; (4) writing promotes learning; and (5) only by practicing the conventions of an academic discipline will students begin to communicate effectively within that discipline.

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Many recent studies of employer expectations of information systems graduates (Hart, 2013) (Pratt, Keys & Wirkus, 2014) have reaffirmed the need to focus on improving the writing skills of our graduates. Curriculum requirements of professional organizations (ABET, 2013) (AAC&U, 2013) (AACSB, 2013) (Attaway, Chandra, Dos Santos, Thatcher & Wright, 2011) (Topi, Valacich, Wright, Kaiser, Nunamaker, Sipior, & De Vreeda, 2010) have reached the same conclusions.

Including writing in courses has both short- and long-term benefits for both teachers and students. In the short term, teachers are better able to gauge how well students grasp information and where they need elaboration of key concepts. In the long run, as more Computer Information Systems (CIS) professors incorporate writing into more courses, students become more efficient at using writing as a communication and learning tool. Especially for more advanced or specialized work in the discipline, the professors reap the benefits of having students who are much better grounded in the fundamentals and ready to engage in more sophisticated analysis of ideas.

Like all language skills, writing skills atrophy when they aren't used. Yet our students often report that they do *no writing at all* during a semester because they don't even take notes during some classes. For students who take only multiple-choice exams, writing can be avoided almost completely for months at a time. Assigning writing in all courses helps students keep their writing skills sharp. Moreover, faculty in all disciplines have discovered that assigning writing in their classes helps students learn material and improve their thinking about ideas in the courses. Writing assigned across the curriculum also helps students prepare for the day-in and day-out communication tasks they'll face on the job, no matter what their job is. Equally important, students need to learn about how writing is used within a discipline, and many kinds of assignments give students practice with disciplinary forms and conventions.

So why assign writing in your Information Systems classes? Students will learn more and will leave the university better prepared to face communication challenges of the profession if they write consistently over the course of a four-year college program. Additionally and much more specifically, students will learn more about the material in their courses at a much greater depth if professors assign writing for their courses.

2. WRITING TO LEARN (WTL)

When considering how Writing across the Curriculum (WAC) has been implemented at a range of universities, the writing assignments generally fall into one of two categories – Writing to Learn (WTL) and Writing in the Disciplines (WID). While some teachers combine the two categories and assign writing that meets the goals of each, many teachers choose to focus on one type or the other.

Writing-to-Learn (WTL) activities are short, impromptu or otherwise informal writing tasks that help students think through and/or discover key concepts or ideas presented in a course (Forsman, 1985). Often, these writing tasks are limited to less than five minutes of class time or are assigned as brief, out-of-class assignments. Writing-to-learn (WTL) activities are considered to be crucial by many WAC programs because they can be used as evidence that students have learned the information and/or suggest areas in which there is an information deficit.

Writing to Learn (WTL) activities can happen frequently or infrequently in a typical class setting. Some can extend over the entire semester, whereas others can be extended to include a wide variety of writing tasks in different formats and to different audiences. Because they are examples of informal writing and are often given impromptu, WTL activities usually aren't marked for correctness. Rather, teachers or classmates quickly read the writing for a general sense of what students understand and don't understand. These activities take very little class time, and most teachers find they can give a quick WTL prompt at the beginning of class while they take roll and as students are settling in. Moreover, many WTL activities can be limited to just a minute or two--the amount of time it might take to answer a student's question about a course concept. Also, because WTL activities are such valuable learning tools, most teachers feel that student's use of any minutes given over to WTL writing is a very effective use of class time.

Although it is not clear exactly how writing fosters critical thinking (Applebee, 1985), both theoreticians and practitioners agree that writing promotes both critical thinking and improved learning (Adams, 1972) (Bruner, 1975) (Emig, 1977) (Herrington, 1981) (Knoblauch & Brannon, 1983) (Odell, 1980) (Parker & Goodkin, 1987). As Fulwiler and Young so succinctly put it (1982, p. x), "Writing to communicate--or what James Britton calls

"transactional writing"--means writing to accomplish something, to inform, instruct, or persuade. . . . Writing to learn is different. We write to ourselves as well as talk with others to objectify our perceptions of reality; the primary function of this "expressive" language is not to communicate, but to order and represent experience to our own understanding. In this sense language provides us with a unique way of knowing and becomes a tool for discovering, for shaping meaning, and for reaching understanding."

Forsman (1985, p.9) makes the same point, but she directs her attention not to a theoretical justification but to a practical rationale for writing to learn. Forsman states, "As teachers we can choose between (a) sentencing students to thoughtless mechanical operations and (b) facilitating their ability to think. If students' readiness for more involved thought processes is bypassed in favor of jamming more facts and figures into their heads, they will stagnate at the lower levels of thinking. But if students are encouraged to try a variety of thought processes in classes, they can, regardless of their ages, develop considerable mental power. Writing is one of the most effective ways to develop thinking."

3. WRITING TO LEARN IN THE SYSTEMS ANALYSIS & DESIGN COURSE

WTL in the Flipped Classroom Approach

Writing to Learn prompts are used in the CIS curriculum as part of the author's "flipped classroom" approach to the Systems Analysis & Design (SAD) course. While different authors espouse different key components of the flipped classroom, there are several components that are essential to all interpretations of the flipped classroom including the following.

The Flipped Classroom approach provides an Opportunity for Students to gain First Exposure to Content Prior to Class. The mechanism used for first exposure can vary, from simple textbook or online readings to lecture videos to podcasts or screencasts. Videos can be created by the course instructor, or found online from sources such as YouTube, the Kahn Academy, MIT's OpenCourseWare, or other similar sources. The pre-class exposure does not need to be high-tech; students can be asked to simply complete pre-class reading assignments and/or engage in writing-to-learn exercises.

Use of the Flipped Classroom should provide an Incentive for Students to Prepare for Class. In all cases, students should be required to complete a task associated with their preparation, and that task should be associated with some points or percentage toward their final course grade. The assignments themselves can vary, ranging from online quizzes to worksheets to short writing-to-learn assignments. In each case the task should provide an incentive for students to come to class prepared by speaking the common language of undergraduates: points. In many cases grading for completion rather than effort may be sufficient, particularly if in-class activities will provide students with the kind of feedback that grading for accuracy usually provides.

The Pre-Class Activity Should Provide a Mechanism to Assess Student Understanding. The pre-class assignments that students complete as evidence of their preparation can also help both the instructor and the student assess understanding. Pre-class quizzes can also allow the instructor to practice Just-in-Time Teaching (Novak, Patterson, Gavrin, & Christian, 1999), which means that the instructor can tailor class activities to focus on the elements with which students are struggling. If automatically graded, the quizzes can also help students pinpoint areas where they need help. Pre-class worksheets also can help focus student attention on areas with which they are struggling, and can serve as a departure point for in-class activities, while pre-class writing assignments can help students clarify their thinking about a subject, thereby providing for richer in-class discussions. Most importantly, the use of pre-class activities provides for the time needed to supply students with much needed feedback in class, reducing the need for instructors to provide extensive commentary outside of class (Walvoord, 1992). Additionally, many of the activities used during class time (e.g., clicker questions, debates, etc.) can serve as informal checks of student learning.

Use of the Flipped Classroom Should Provide In-Class Activities that Focus on Higher Level Cognitive Activities. Given that the students have gained basic knowledge outside of class, class time can now be spent promoting deeper learning. The in-class activity selected will be dependent upon both the learning goals of the course and the culture of the discipline. For example, Lage (2000) describes experiments students did in class to illustrate economic principles, while Mazur (2009) focuses on student discussion of conceptual "clicker" questions and quantitative problems which focused on physical science principles. Other in

class activities may consist of debates, data analysis, or synthesis activities. What is important, regardless of the activity chosen, is that students are using class time to deepen their understanding and increase their skills at using their newly acquired knowledge.

Writing to Learn in the Flipped (SAD) Course

The use of WTL prompts as part of the flipped classroom approach for the SAD course was first implemented in the fall of 2013, and is currently in its third iteration. The course consists of an opening unit which concludes with students being assigned to project teams, after which the teams are assigned to improve a particular system/application in either the on campus or off campus environments.

The typical daily classroom unit consists of the following pattern: (1) Students receive a Research Question (WTL prompt) at the close of the prior class; (2) Students post their individual answers to the research question to the Blackboard course management system no later than midnight of the evening prior to the class session in which the topic will be covered in class; (3) The actual class session opens with either an additional WTL prompt followed by a 10-15 minute comparison of the student answers, or just the 10-15 minute comparison of student answers. During the 10-15 minute session students search for commonalities in their answers, following which the students collectively decide which information to archive for summative assessment at a later date; and (4) Students then apply their understanding of the answers to their particular system or application.

For example, applying the pattern to the SAD class session covering System Requirements:

- Student Research Question: What are system requirements? What is the difference between functional system requirements and non-functional system requirements?
- In class, after the opening discussion, student project teams work together to define the functional and non-functional system requirements for their system or application.
- Project teams quickly come to realize that they cannot accurately define their requirements without input from the system stakeholders (a topic that was covered 2 weeks earlier in the course).
- Students are then provided with their research question and/or assignment that is due prior to the next class session. In particular, students are asked to find commonly employed techniques to gather data and to determine which data gathering technique(s) would be most appropriate to collect data from each class of stakeholder, which provides input for the following class session which covers Data Gathering Techniques.

Student postings to the course management system are usually graded on a 2-point scale with 0 = answer not submitted by the deadline; 1 = standard Wikipedia answer; 2 = additional source(s) used to provide their answer. No late postings are accepted because all research assignments are posted to the course management system well in advance of the required due dates.

At the close of each class session, students and faculty together decide which information would be best archived for those students who missed class due to illness or other higher priority interventions. This archived material becomes the basis for summative assessments that provide for individual accountability in what is predominantly a team-based course producing team-based project deliverables.

The flipped classroom approach employed herein is not merely a synonym for either viewing online videos or searching for information on the internet. Rather, it is the in-class interactions and carefully designed learning activities that occur during classroom face-to-face time that are the most important part of the flipped classroom. Students do not work without structure in class, nor do they work in isolation, nor do they spend the entire class time staring at a computer screen. Rather, the flipped classroom is an opportunity to increase intentionally designed and meaningful interactions between students and faculty.

4. WRITING IN THE DISCIPLINES (WID)

Writing in the Disciplines

The second category of WAC is called Writing in the Disciplines (WID). WID assignments are designed to introduce or give students practice with both the language conventions and specific formats typical of a given discipline. For example, a feasibility study would include much different information in a unique format that would differ greatly from an annual business report or an engineering lab report.

Most WID assignments are formal documents prepared over a few weeks or even months. The

final documents adhere to the format and style guidelines of project deliverables typical of the professional genres they are helping students learn about. Teachers comment primarily on the substance of these assignments, but teachers also expect students to meet professional standards of both layout and proofreading (Russell, 1991).

Although the research essay is the most common kind of WID assignment, there are many other formats that can be used to teach students about disciplinary writing conventions. For example, in the Systems Analysis & Design course students produce the following types of documents to understand the thinking and writing of the systems development process: (1) a record of the initial client meeting(s); (2) a systems requirements document; (3) a feasibility study; etc.

In addition to discipline-specific formats, other kinds of writing assignments can help students learn the language and ways of thinking of a discipline, even though they may not mimic its professional writing. Any of the following writing activities can provide the basis for a longer, more formal assignment, or can be used only to promote class discussion and/or thinking about course material: (1) *Reading Journa*l – jotting down specific thoughts regarding an assigned reading; (2) *Jargon/Term Journal* – jotting down terms and their meanings when confronted with new discipline specific terminology; (3) *Rhetorical Analysis* – reading an article and analyzing its meaning; for example, a mini-case study emphasizing an important point; and (4) *Popular Article* – for example, our students do a "Tech Week in Review" single-page analysis of tech happenings on a weekly basis in our introductory course

One reason that students report feeling overwhelmed by WID tasks is that they aren't sure where to start and then how to proceed to produce a good project of the sort required by the assignment. One can assist students--and consequently receive better final drafts to read--by setting up a sequence of tasks that build toward the final project. Two approaches work well when designing a sequence: (1) break the large writing task into chunks so that students can tackle parts of the assignment and get feedback before moving to the next chunk; or (2) alternately, devise tasks that build on each other. For instance, if the assignment is to conduct a professional literature review as the final project, first have students write abstracts or summaries of articles, then ask for annotations, and finally ask for synthesis. At the same time, have students analyze published articles to determine what a review of literature typically looks like in the field. By giving students a sequence of writing and analytic tasks, they become more confident and more able to meet the criteria for the final writing task.

Successful writing assignments depend on careful and thorough instructions and preparation and on explicit criteria for evaluation. Although individual experience with a given assignment will suggest ways for assignment improvement, following explicit guidelines in initial assignment construction can assist in avoiding potential problems with student writing and thus makes for both better writing and thereby considerably reduced grading time. Good writing assignments always start with a clear goal that the teacher can express, usually included on the assignment sheet so that students also understand the goal of the assignment.

Good writing assignments also often take shape by thinking backwards; in effect, teachers ask themselves, "What do I want to read at the end of this assignment?" By working from what they anticipate the final product should look like, teachers can give students detailed guidelines about both the writing task and the final written product, including: (1) rhetorical aspects of the task; i.e., who is the audience for the finished product, the purpose of the assignment, and writing situation; (2) required sections and elements of the writing assignment; (3) grading criteria which should be included on the assignment sheet; and then (4) breaking down the writing task into a manageable steps.

5. WID IN THE SYSTEMS ANALYSIS & DESIGN COURSE

Discipline based writing assignments are present in almost all required CIS courses at the author's university. In the Systems Analysis & Design (SAD) course project teams do an analysis and redesign of a real world information system. Project teams do several WID activities commencing with the developing a Team Charter, a formal document that defines the purpose of the team, expected outcomes, and ground rules for working together to produce the results. In effect, a team charter is a set of agreements created to ensure that everyone is on the same page regarding project team norms from the start of the project.

Following the development of the team charter, project teams are assigned to one of several real-world applications and required to produce specific deliverables through the Requirements, Analysis, and Design phases of the Systems Development Life Cycle (SDLC). Specific WID assignments treated as project deliverables in the author's SAD course include: (1) a summary report of the *initial client meeting*, a meeting held to define the projects goals, define data availability, discuss implementation issues, and discuss project planning/scheduling; (2) a *problem definition statement* which is a concise description of the issues that need to be addressed by the project team; (3) a *system scope statement* which in effect establishes the boundaries of the study by establishing the project deliverables and major objectives of the project; (4) a *system request* which formally establishes the project goals and objectives ; (5) a *feasibility analysis* which is conducted to determine if the problem can be solved effectively from operational (will it work?), economic (costs and benefits), and technical (can it be built?) viewpoints; (6) a *requirements definition report* which formally establishes what the system must produce within the established organizational parameters; (7) a *system specification* (which includes the leveled set of DFD's, process specifications, and a data dictionary; and (8) a *system proposal* which includes all of the first seven components preceded by an executive summary.

6. RESULTS & CONCLUSIONS

The use of WTL prompts both prior to and/or at the beginning of class sessions has increased student engagement both outside of the classroom and inside the classroom. Students have increased their reading outside the classroom because they have read online material to answer research questions related to course content prior to encountering the content in their classes. Because they have available to them the answers that they submitted the evening prior to the class, students are much more engaged in the daily course content which serves to foster much more lively class discussions.

The use of WID assignments in successive courses has both addressed the need for effective writing and increased the quality of student writing as students have progressed through the curriculum. As the quality of student writing has improved via the constant reinforcement of writing assignments, students have learned to think at a higher level. As Zakaria (2015) so effectively proffers, "The central virtue of a Liberal Education is that it teaches you how to write, and writing makes you think. Whatever you do in life, the ability to write clearly, cleanly, and reasonably quickly will prove to be an invaluable skill."

The presence of WTL assignments which increase student engagement in the course content both in and out of the classroom, coupled with the use of WID assignments in successive courses which have greatly increased the individual student's writing ability, has effectively produced undergraduates whose writing skills and field-specific knowledge are closer to being in alignment with the expectations of the employers of our graduates. Though longitudinal studies are nearly impossible to conduct due to the absence of a control group, individual student writing has exhibited great improvement over the course of their four-year undergraduate experience.

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Editor's Note:

This paper was selected for inclusion in the journal as a EDSIGCon 2015 Distinguished Paper. The acceptance rate is typically 7% for this category of paper based on blind reviews from six or more peers including three or more former best papers authors who did not submit a paper in 2015.