

Using Business Writing in the Engineering Classroom

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The University of Maine requires each academic program to have two writing intensive courses within their academic discipline. Under this requirement, assignments are reviewed for both technical and grammatical aspects. Students are given an opportunity to revise the assignment for a final grade. CET 356 Construction Documentation is designated as a writing intensive course. Students are assigned four written assignments based on a common case history of a building that is on the university campus. Students write a formal business letter, a set of business memos, a set of field notes, and the minutes of a construction progress meeting. Students are provided with sample formats for each of these types of written products. Instructor evaluation for each exercise is through rubric that measures instructor defined quality traits. This paper describes the process of creating the exercises and initial evaluation results from one implementation of the course.

Keywords: Evaluation Rubric, Student Writing Exercises, Writing Evaluation, Writing Intensive Curriculum

Introduction

In addition to the traditional English grammar and writing courses that students normally take, the University of Maine requires all students to take two writing intensive courses within their respective discipline of study. Under the University's guideline for writing intensive curriculum, courses within a specific discipline that are designated as writing intensive are structured to include writing exercises that are relevant to the specific discipline. Students prepare the written assignments given by the instructor who, in turn, reviews the assignment for both technical content and appropriate composition. The student is then allowed to revise the assignment based on the instructor's review comments and to resubmit the assignment for a final grade. The purpose of these writing intensive courses is to give students better practice communicating discipline specific concepts in professional formats that they will use in their professional careers.

Two courses within the Construction Management Technology Program (CMT) in the School of Engineering technology are designated as writing intensive. These courses are CET 356 Construction Documentation and Administration and CET 451 Construction Law. CMT professors who teach these courses create, assign, and evaluate the practical written exercises for both technical content and adequate composition. This paper describes the development and evaluation of exercises as used in CET 356 in 2005. (Dunn, 2005; Dunn, 2006)]

Development of Exercises

The CMT program develops academic courses in cooperation with an Industrial Advisory Committee (IAC). The IAC is an active group of practicing construction and engineering professionals who provide recommendations as to what they feel is important to the construction

profession. Through the advice of the IAC, CMT faculty modifies course content so that students are exposed to areas that meet the needs of industry. In consortium with the IAC, CMT faculty identified some of the main written products commonly used in industry that new graduates seem to have the greatest difficulty to write. These written items include business letters, business memos, field notes, and meeting minutes.

Maine's CMT program is a four year ABET accredited program. Under the guidelines of TC2K/ABET criterion 2, several objectives clearly lend themselves to articulate writing skills:

- a. demonstrate an appropriate mastery of the knowledge, techniques, skills, and modern tools of their discipline,
- b. apply current knowledge and adapt to emerging applications of mathematics, science, engineering, and technology,
- f. identify, analyze, and solve technical problems,
- g. communicate effectively,
- h. understand professional, ethical, and social responsibilities. (Accreditation Board for Engineering and Technology)

These ABET objectives are met through the development of written exercises that make students present clear, logical, and technical discussion about various circumstances. The circumstances are related to the technical knowledge for which the student is trained, but the solution, as determined, must be articulated to someone else. The audience for many of the written exercises may not be technically trained, yet has a stake in the decision. Construction managers, on an active construction project, need to communicate technical information and make decisions both internally and externally to the immediate construction project. The manager needs to communicate routine information to the immediate construction team and make decisions based on the information at hand. At the same time, the construction manager needs to follow the intent of the specifications and plan while maintaining an acceptable profit. This balancing of project priorities emphasizes the need to be an effective communicator.

In order to create realistic and effective exercises, the CMT faculty decided to use a newly constructed on campus building as a case study. The Advanced Manufacturing Center is a typical light manufacturing building that includes both open space and academic offices. Because the building is new, most of the actual plans and specifications are available for use in the classroom. Potential situations were created based on the plans and the possible issues that typically occur between the contractor and owner. The actual names of the owner: the University of Maine and the contractor: JCN, Inc. were used throughout the scenarios that the students created.

Assignment I - Business Letter

In the first assignment, the student took the role of the owner's onsite inspector. The inspector made a routine inspection and found a couple of problems at the site. Installed drywall is not to specification and the joining seams are improperly finished. In addition, the inspector finds out that the work was improperly authorized by the contractor's onsite superintendent. As the owner's representative, the inspector needed to point out the deficiencies and to define his project authority. Under the assignment, the student wrote a letter to the construction company

owner to define the problem and to get an immediate solution. The student is not told what the decisions must be, but rather is left to his or her own discretion to put forth a resolution.

This exercise forced the student to develop a logical argument that directed an agreement with the contractor. The student needed to apply his construction knowledge, common sense, and strategy that can best solve the situation. ABET objectives a, f, g, and h are applicable. Even though following the letter of the specification may be the proper thing to do, is it the practical solution considering time and budget? A joint resolution needs to be developed between the contractor and owner to facilitate the project. Many students direct the removal of the unspecified materials, many demand a meeting, and others have suggested a reduced compensation.

Under the writing intensive application, students created the letter and submitted it for review. The instructor created a rubric that defined evaluation traits and established assessment criteria based on a scale of 1 to 10 for each of the traits evaluated. This evaluation rubric is shown as Table I.

TABLE I
BUSINESS LETTER EVALUATION

Trait	Low Points (1-5)	High Points (6-10)
Grammar	Improper tense, spelling (3> spelled incorrectly)	Consistent noun/verb agreement, readability
Punctuation	Lack of commas and periods, run-on sentences	Proper use of colons, lists, and capitalization
Style	Unclear thoughts	Smooth reading and clear
Tone	Sarcasm, passive tense	Positive positioning
Content	Missing concerns	Includes relevant points
Resolution to Situation	Doesn't address problems	Leads to agreement
Mechanics of Presentation	Missing structure provided	Contains guideline material
Wrong Drywall	Not Identified	Identified
Bad finish	Not Identified	Identified
Authority	Not mentioned	Mentioned

The instructor reviewed the assignments using the rubric and returned them to the students for revision for a final grade. Several common problems were noted in the first submittals:

- Writing styles were weak. The students tend to provide illogical sequences for ideas conveyed in the letter.
- Tone is sarcastic. Many students use passive voice and imperative sentence structures. These combinations can be abrupt to the reader.
- The content and three problem areas were not all identified. Even though the assignment spelled out the problems, many individual students tended to leave out at least one of the major points.
- No resolutions were identified. The letters didn't force a meeting or decision as to what should be done for corrective actions.

After the assignments were resubmitted with revisions, the instructor used the same rubric to give students a final grade. Table II shows the resulting percentages of where the aggregate student class sample received quality points as evaluated by the instructor through the rubric.

After the revising their business letters, students improved in their general grammar, punctuation and overall quality of the letter. They better identified the issues involved with the situation. Some students sought direct resolution to the situation by directing the contractor to remove the unspecified drywall and other students wanted a meeting to discuss the issue. Many of the students made the suggested revisions, but some tended to forget detail and still left out some of the important information found within the inspection.

TABLE II
STUDENT QUALITY RATINGS FOR BUSINESS LETTER

Trait	1	2	3	4	5	6	7	8	9	10
Grammar							0.27	0.53	0.19	
Punctuation							0.07	0.40	0.53	
Style							0.10	0.63	0.27	
Tone								0.47	0.50	0.03
Content								0.47	0.43	0.10
Resolution to Situation							0.10	0.40	0.30	0.20
Mechanics of Presentation								0.20	0.47	0.33
Wrong Drywall								0.03	0.03	0.93
Bad Finish									0.13	0.87
Authority							0.07	0.03	0.17	0.73

Assignment 2 – Minutes Of a Meeting

For the second assignment, the student is the official recorder for a weekly construction meeting between the owner and the contractor. The student recorded the action of a meeting that had been taped earlier that illustrated the principles of a business meeting following the general case history associated with the Advanced Manufacturing Center. Using the logical order of events that could take place on a construction project, this meeting would typically result from the issues that had been raised through the formal business letter of assignment 1.

In order to develop this assignment, the instructor created a fictitious meeting in cooperation with students in the University’s Theater Department. A minor grant from the University’s Center for Teaching Excellence paid for studio time and the materials used for props. The instructor wrote an extemporaneous script that laid out the project situation as had been noted in the formal business letter. Six meeting participant characters were developed that presented stereotypical personalities associated with a construction project. Three characters represented the construction contractor: the construction company owner, the project superintendent, and a site foreman; three characters represented the owner: the University’s Director of Physical Facilities, the project manager, and the project engineer. Student actors were allowed to create the characters as they wished and to embellish the extemporaneous script as needed. Theater students used their imaginations to create individual appearances, mannerisms, and dialog between characters. Within the context of the script, two distracting points were introduced into

the dialog: a disparaging remark against a female attendee and a loud verbal exchange. The University's Informational Technologies Department built a stage set to look like the interior of a typical construction office trailer and filmed the performance. Because the instructor asked that the video be about 15 minutes long, Informational Technologies edited the film to meet the constraint. The finished video begins by showing segments of exterior building construction, presents the construction meeting, and ends with continued shots of exterior building construction. Though these exterior scenes are not of the actual onsite project used in the case history, these segments create the illusion that the meeting is part of the construction project that is shown in the clips. Because the CMT students did not know the theater students, the instructor had face shots with names for each of the characters shown just prior to the action depicted for the construction meeting.

CMT students were given an overview of the importance of taking minutes in a meeting. They were given sample minutes and told that they could adopt their own individual style for purposes of the exercise. The students watched the video in class and recorded their individual version of the action.

The script followed an order of typical business meetings:

- Call to order
- Review of minutes from previous meeting
- Review of construction work since last meeting
- Discussion of new business and upcoming work
- List of action items
- Establish time for next meeting

Students viewed the video and recorded the minutes that they witnessed. They submitted these draft minutes for review. The instructor created a rubric to evaluate the minutes and similarly to the first assignment developed a point value for various quality traits. This rubric is shown as Table III.

**TABLE III
MEETING MINUTES EVALUATION**

Trait	Low Points (1-5)	High Points (6-10)
Attendees	Not listed, Missing Names, Misspelled Names	All attendees noted, Only 1 missing, Only minor spelling mistakes.
Dates, Location, Time	Not noted, Missing any of the items	Properly noted, missing only one item
Logical Order	Missing discussion points in the order of discussion, Incomplete sentences or thoughts	Follows the sequence of the meeting. Uses complete sentences and completes thoughts
Details of Discussion	Misses points of discussion, illogical items discussed.	Gives accurate accounting of the points discussed.
Presentation	Sloppy, hard to follow	Easy to follow, clear
Grammar, Spelling	Improper tense, spelling (3> spelled incorrectly) Lack of commas and periods, run-ons	Consistent noun/verb agreement, proper use of punctuation
Summarization	Does not summarize points as discussed	Summarizes points discussed.
Drywall	Not mentioned or incorrectly noted	Mentioned and noted properly
Seams	Not mentioned or incorrectly noted	Mentioned and noted properly
Range Hoods	Not mentioned or incorrectly noted	Mentioned and noted properly

The instructor reviewed each assignment using the guideline of the rubric. The reviewed assignments were returned to the students with suggested revisions. Students corrected the assignments and submitted them for a final grade. The grading results for the revised assignment are shown in Table IV.

**TABLE IV
STUDENT QUALITY RATING FOR CONSTRUCTION MEETING**

Trait	1	2	3	4	5	6	7	8	9	10
Attendees					.04			.15	.37	.44
Dates, Location, Time								.04	.48	.48
Logical Order						.07	.11	.19	.56	.07
Details of Discussion						.11	.26	.33	.26	.04
Presentation						.04		.48	.44	.04
Grammar, Spelling, Etc.							.11	.52	.33	.04
Summarization of Points				.04	.15	.11	.15	.22	.22	.11
Drywall							.19	.36	.26	.19
Seams							.22	.33	.26	.19
Range Hood						.07	.11	.44	.19	.19

The assignments of first draft meeting minutes had several noted weaknesses. Students had difficulty reporting detail and confused the sequence of discussed events. Items that were reviewed in the beginning of the meeting under previous meeting minutes became the active items for new business. After students had the confused details explained, the revised minutes

were greatly improved. It is interesting to note that there were two staged events put within the video to see if students recorded these events in the minutes. The first event consisted of a female from the contractor's team calling a female from the University's team "honey." The University's employee corrected the first employee about the remark. The second event was the contractor raising his voice to his superintendent and menacingly standing over the person to emphasize his point. None of the students recorded these extraneous incidences. Although the revised minutes were better, the students tended to still get lower scores in the areas of logical order, details of discussion, and summarization of points.

Assignment 3 – Business Memos

Continuing the evolution of this case study in the third assignment, students took the role of the owner of the construction company who attended the project meeting with the project owner as was depicted in assignment two. Because email is prevalent in modern business practice, many companies no longer tend to use paper formats. However, since a business memo is parallel to the style of email, an exercise using traditional memos was created to reinforce the power of email.

After the meeting with the owner, the contractor realized that he should write three memos to resolve issues and to clarify information brought out in the meeting. First, a memo should be written to the owner to confirm what action items the contractor will do. Second, a memo should be sent to the onsite superintendent to redirect the work schedule to prioritize the replacement of the drywall. Third, a memo should be sent to the superintendent to reprimand her actions for authorizing project changes without proper clearances.

Students will become professional construction managers and most likely will need to generate similar memos for clarifying the owner-contractor project relationship, redirecting work schedules, and reprimanding employees for jobsite actions. The instructor created an evaluation rubric that assesses many of the same traits reviewed in the formal letter exercise. Instead of evaluating the last three items of poor drywall, bad seams, and missing range hood, the rubric rates the quality of the memo to the University, to the superintendent, and to the employee.

The instructor distributed sample memo format styles and discussed the assignment in terms of email. He emphasized the need to have proper style because many emails are now printed and used as part of the project documentation. The evaluation rubric is shown as Table V.

TABLE V
BUSINESS MEMO EVALUATION

Trait	Low Points (1-5)	High Points (6-10)
Grammar	Improper tense, spelling (3> spelled incorrectly)	Consistent noun/verb agreement, readability
Punctuation	Lack of commas and periods, run-on sentences	Proper use of colons, lists, and capitalization
Style	Unclear thoughts	Smooth reading and clear
Tone	Sarcasm, passive tense	Positive positioning
Content	Missing concerns	Includes relevant points
Resolution to Situation	Doesn't address problems	Leads to agreement
Mechanics of Presentation	Missing structure provided	Contains guideline material
University Memo	Did not include all of the agreed points	Included all of the agreed points
Superintendent Memo	Did not direct change of work	Directed work changes
Employee Memo	Threatened firing and disciplinary actions	Reprimanded

Students prepared the three memos as assigned using their knowledge of the case history to date with the increasing developments through the class exercises. The memos were submitted to the instructor for review and first draft evaluation. Generally, the memos were good with only minor revisions suggested. Two problems were noted:

- Overall grammar and punctuation needed improvement. Many students wrote as they would an informal email to friends and disregarded professional presentation.
- Memos to the specific parties were too general. Many students wrote memos that did not direct the superintendent to change the work nor reprimand the employee for unauthorized work changes.

Revised memos were submitted and greatly improved. Table VI shows the results of quality ratings for the revised memos.

TABLE VI
STUDENT QUALITY RATING FOR BUSINESS MEMOS

Trait	1	2	3	4	5	6	7	8	9	10
Grammar							0.14	0.62	0.19	0.05
Punctuation							0.24	0.43	0.29	0.05
Style							0.24	0.43	0.19	0.10
Tone							0.14	0.52	0.24	0.10
Content						0.05	0.14	0.33	0.38	0.10
Resolution to Situation							0.05	0.43	0.38	0.14
Mechanics of Presentation							0.10	0.19	0.57	0.14
University Memo							0.14	0.52	0.24	0.10
Superintendent Memo							0.10	0.52	0.33	0.05
Employee Memo							0.05	0.57	0.24	0.14

Assignment 4 – Field Notes

In the last assignment, students were assigned as site inspectors with the responsibility of taking field notes. Since the building used in the case study had already been built, information from another active construction site was used. The instructor videotaped the construction of the installation of parts of a pile foundation system on an active bridge construction project. Many buildings are supported on a pile system and notes associated with such operations are part of the case study used throughout the semester. The pile installation was filmed for approximately a half hour.

The instructor explained the importance of accurate field notes on a construction project. He distributed copies of typical field notes and showed some of the common features that most field notes contain. He also distributed pile measurement and identification notes actually generated at the project site where the video footage was filmed. He then showed the video in class and had the students record their observations in the form of field notes. These notes were then submitted for review. The instructor developed an evaluation rubric for the field note exercise as shown in Table VII:

TABLE VII
FIELD NOTE EVALUATION

Trait	Low Points (1 to 5)	High Points (6 to 10)
Who	Lack of Contractor ID	Contractor ID
What	Lack of major site action	Incorporates site activity
Where	Lack of orientation	Specifies locations
Equipment	Doesn't state what is onsite	Lists equipment
Weather	Doesn't mention	States weather conditions
Measurement	Doesn't measure in place items	Records measurements
Mechanics of Presentation	Improper format	Proper format
Clarity	Hard to follow	Easily followed
Details	Leaves out facts	Incorporates site information
Time	Leaves out times	Includes times for events

Students submitted their notes for review. Generally, there were several areas of weakness in the first draft of the field notes:

- The onsite contractors performing the work were not clearly identified as to who was doing what.

Two different contractors were working on the site and student field notes did not differentiate.

- The locations of the various driven piles were not noted.
- Measurements of driven depths were not recorded.
- Time and details were not recorded with accuracy.
- Weather observations were recorded, but safety considerations were not noted. There were no

references to the integrity of the cofferdam or any of the safety constraints visible on the site.

The instructor suggested revisions to the first draft notes and returned them to students. The resulting notes were then revised and resubmitted for grading. The results of the second submittal of the assignment are as shown in Table VIII:

**TABLE VIII
STUDENT QUALITY RATING FOR FIELD NOTES**

Trait	1	2	3	4	5	6	7	8	9	10
Who					0.04	0.28	0.50	0.17		
What					0.02	0.07	0.74	0.17		
Where					0.07	0.26	0.46	0.13	0.07	0.02
Equipment					0.02	0.04	0.24	0.41	0.09	0.20
Weather							0.04	0.22	0.57	0.17
Measurement		0.61	0.02	0.02	0.11	0.02	0.09	0.09	0.02	0.02
Mechanics of Presentation						0.02	0.33	0.48	0.15	0.02
Clarity							0.52	0.43	0.02	0.02
Details					0.04	0.07	0.50	0.26	0.11	0.02
Time			0.02		0.52	0.09	0.02	0.11	0.17	0.07

Even with standard measurement information provided and suggested revisions, many students still did not make reference to pile measurements within the field notes. Some students still did not indicate who, when, and what in reference to the work taking place within the project site. A significant number of students also did not note times of installed piles.

Summary and Conclusions

The University of Maine requires each academic discipline to have two writing intensive courses within their respective program. Writing intensive courses integrate standard writing practices with technical information in standard professional documents. Students are given the opportunity to create relevant work within their technical discipline as they will within their chosen profession.

Using writing intensive criteria, CET 356 coursework assigns four typical business documents to students based on a construction project as a case history. These documents include a formal business letter, a set of meeting minutes, a series of memos, and a set of field notes. Students experience meeting minutes through a video presentation created in conjunction with the Department of Theater and Dance based on a grant through the Center for Teaching Excellence. CMT students experience field notes through a video presentation filmed at an active Maine Department of Transportation construction project. Through the revision process, students received feedback on their work and had opportunity to change it for final grade.

In general, several observations can be made:

- Students understand the mechanics of a formal business letter. They have difficulty maintaining logical order and discussion throughout the letter. Some grammatical skills are weak. Many students tend to write in the past tense and sarcastic tone results. In the writing exercise that was assigned to the students, not all of the parameters were presented in the letter and no resolutions were defined.
- Students had difficulty reporting adequate detail within a business meeting. They tended to confuse the sequence of discussion which resulted in misrepresenting the actual detail. Students also did not record irrelevant information presented within the content of the meeting. Revised minutes showed improvement in the accuracy of the details.
- Students had weak grammatical skills in preparing memos. They were too informal in their presentations and disregarded some professional memo protocols. With a series of memos, students did not easily transition to varied circumstances and different audiences. Their memos did not always convey direct intent. After revision, grammar improved with prompting from the instructor feedback.
- Students left out detail in preparing field notes. They did not note some details such as time and measurement. For whatever reason, some students left out the important aspects of whom, what, and where for recording the action at the construction site. After the input of the instructor, the detail improved.

The writing intensive curriculum provides students the opportunity to prepare written products in the form that they will use in professional practice. The exercises indicate that this class needed prompting to prepare grammatically correct products. Students tended to be weak in capturing

details and could improve with some prompting from the instructor. When held accountable for the detail and grammar, the resulting written products showed improvement. Students confuse the style of written memos, ie. e-mail, with text messaging. Though students take traditional English courses, they seem to forget some of the traditional concepts taught and do not always put these concepts in the professional written products. When held accountable for the information, most students put better efforts forward.

Future exercises in this course will include using PDAs (personal data assistants) to record field notes, new site filming for field note, and different handouts to illustrate field measurement. The minutes exercise will be improved through more samples of meeting minutes, some editing to the existing video, and an agenda for discussion items. The formal business letter will be improved through creating a response letter tailored to the student letter as feedback. This letter will respond to the student based on the information in the initial letter. Similarly, response memos will be returned to react to the first draft memos created by the student.

By using realistic exercises, students are immersed in situations that require better written communication skills. These exercises help the CMT program better meet the intent of TC2K/ABET criterion 2 to develop better students ready to meet the challenges of the future.

Acknowledgment

The author thanks the Department of Theater and Dance and the Instructional Systems Department for their cooperation in developing the Meeting Minutes video. He also thanks the Center for Teaching Excellence that provided a minor grant to assist in putting together this video.

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