A Study of the Effect of Instructor Feedback and Students' Written Reflections on the Oral Communication Skills of Electrical Engineering Students

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October 28, 2011

II. ABSTRACT

The Electrical and Computer Engineering (ECE) department and the Communication Across the Curriculum (CAC) program propose funding for the first implementation year of a two-year research project to study the impact of instructors' written feedback and students' written reflections on electrical engineering students' speaking skills. Four design courses—sophomore, junior, and two senior design classes—provide the project's framework. The research involves assessing the presentations of a select group of project students and an equal number of control group students, beginning with the sophomore design class and continuing through the two senior design courses.

We will first give project students feedback on an analytic rubric, then they will view their videotaped presentations and write a reflective paper on their performances. The control group will not receive feedback, although their presentations will be scored using the rubric. At the conclusion of the senior design class, a statistical analysis of the data is expected to support the project's **overall objective**: that students' speaking skills will improve with multiple opportunities for practice and feedback.

The ECE department will benefit because communication skills are criteria by which the department is judged for accreditation. The university community will benefit from the knowledge created because our findings will address oral communication goals stated in the UNC Tomorrow report. We see this project as having the potential to increase student engagement in the discipline, and hope it will become a campus-wide model of how pedagogical revision can speak to the objectives of the Quality Enhancement Program.

III. Budget Request Form and Budget Narrative

Budget Request for SOTL Grant
Year 2012

Joint Proposal?	__x__ Yes _____ No
Title of Project	A Study of the Effect of Instructor Feedback and Students' Written Reflections on the Oral Communication Skills of Electrical Engineering Students
Duration of Project	Two years. We are only requesting funding for the first year.
Primary Investigator(s)	Mehdi Miri, Jean Coco, Robert Cox, James Conrad, Nan BouSaba
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UNC Charlotte SOTL Grants Previously Received (please names of project, PIs, and dates)

Allocate operating budget to Department of   Electrical and Computer Engineering

Account #	Award	Year One
		January to June 2012
Faculty Stipend	Transferred directly from Academic Affairs to Grantee on May 15	6,000
911250	Graduate Student Salaries	4,440
911300	Special Pay (Faculty on UNCC payroll other than Grantee)	
915000	Student Temporary Wages	
915900	Non-student Temporary Wages	
920000	Honorarium (Individual(s) not with UNCC)	
921150	Participant Stipends	
925000	Travel - Domestic	
926000	Travel - Foreign	
928000	Communication and/or Printing	
930000	Supplies	
942000	Computing Equipment	
944000	Educational Equipment	1,500
951000	Other Current Services	
	GRAND TOTAL	$ 11,940

Attachments:

1.   Attach/provide a narrative that explains how the funds requested will be used.

2.   Has funding for the project been requested from other sources? _x__ Yes   __ __ No. If yes, list sources.

    The Communication Across Curriculum Program (CAC) has agreed to fund this project during the second year. The funds requested from SOTL are for the first year of this project.

Budget Narrative

<u>Faculty Stipends:</u>

The project faculty and their responsibilities are summarized in the table below.

Project Faculty	Responsibilities
Mehdi Miri: Sophomore Design Instructor (9-month employee)	- Divide sophomore design students into project & control groups - Work with TA to put in place data collection/analysis tools - Attend working meetings in summer 2012 - Assess all students' oral presentations using the common rubric - Provide project students in sophomore design with feedback - Add sophomore design data to common database - Lead the statistical evaluation of the collected data - Lead the writing of the final report
Robert Cox: Junior Design Instructor (9-month employee)	- Attend working meetings in summer 2012 - Assess all students' oral presentations using the common rubric - Provide project students in junior design with feedback - Add junior design data to common database - Help with writing of the final report
Nan BouSaba: Senior Design Instructor (12-month employee)	- Attend working meetings in summer 2012 - Assess all students' oral presentations using the rubric - Provide project students in senior design with feedback - Add senior design data to common database - Help with the writing of the final report
Jim Conrad: Helping with Senior Design (9-month employee)	- Attend working meetings in summer 2012 - Assess senior design students' oral presentations using the rubric - Help with writing of the final report
Jean Coco: Communication expert (9-month employee)	- Organize and lead working meetings in summer 2012 - Assess students' oral presentations once in each class - Provide project students with feedback once in each class - Develop post-presentation reflective writing prompts - Assist with the writing of the final report

All five project faculty are expected to assess all students' oral presentations using the common analytic rubric to provide project students with feedback on their presentations and reflections, to convert and add the rubric data to our common database, to attend working meetings in summer 2012 in order to streamline the data collection and compilation processes, to help with the statistical analysis of the collected data, and to help with writing the final report. Four of the project faculty are 9-month employees and the requested stipends are for their work during summer 2012.

<u>Graduate Teaching Assistants:</u>

We would like to hire a TA during spring 2012 semester to help with the development of software tools for recording the rubric data collected by the different design faculty in our common database, to help put in place the statistical analysis tools needed in the evaluation phase, and to videotape the project students' oral presentations. We would like to hire this TA for 210 hours at the SOTL rate of $12/hour. This would total to $2,520 in Spring 2012. We would like for this TA to continue during summer 2012 to update the developed tools

based on the experience gained in the sophomore design class. We are requesting $1,920 to pay this TA in summer 2012 for 160 hours.

Video Recording Equipment:

Video recording gear is needed for videotaping students' presentations and for uploading the videos to the project website so that it can be viewed by the students and by the project faculty. We estimate the cost of the camera, tripod, memory cards, computer interface cable, and an extra battery to be $1,500.

A potential vendor for this equipment is Canon U.S.A. at
 http://www.usa.canon.com/cusa/professional/products/camcorders/compact_high_definition_camcorders

IV. Letters of Support

UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

Office of the Dean

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To: Faculty Scholarship of Teaching and Learning Grant Committee

From: Robert E. Johnson, Dean
        Lee College of Engineering

Date: October 21, 2011

Re: Endorsement of College Faculty Participation in a SOTL Grant Proposal

I strongly support the participation of the Electrical Engineering design faculty in the proposed research project. Oral communication skills combined with technical competence is essential for the professional development of our students, and it is the main ingredient for becoming successful engineers after graduation. Any effort to improve the communication skills of our engineering students would have my utmost support. This two-year project would answer key questions on how to improve the pedagogy of imparting effective oral communication skills. The four design classes chosen as the framework for the project are well suited for answering the research questions posed. The project faculty, Mehdi Miri, Robert Cox, Nan BouSaba, and Jim Conrad are experienced design teachers, and I have confidence in their abilities to conduct the proposed study. Their collaborations with the Communication Across Curriculum Program give me further assurance that this project will be successful if funded. Please feel free to contact me if you need more information.

UNC CHARLOTTE
University College
Office of the Dean

MEMORANDUM

To: Faculty Scholarship of Teaching and Learning (SOTL) Grants Committee

From: John Smail
        Dean

Date: October 28, 2011

Re: Endorsement of SOTL Grants Proposal

I fully support this proposal for a Scholarship of Teaching and Learning Grant to fund a collaborative project between the Communication Across the Curriculum (CAC) program and the Electrical and Computer Engineering (ECE) department. Jean Coco, the Interim Coordinator of CAC, is submitting this proposal with the Electrical and Computer Engineering design faculty, and together they will investigate the impact of instructors' written feedback and students' written reflections on oral presentations in the sophomore, junior, and senior engineering design courses.

This project addresses goals articulated in the UNC Tomorrow report that focus on the need to prepare students for the 21st Century by developing their oral communication skills. With the support of the CAC program, this project will situate communication practice in the ECE major to improve students' speaking skills with practice over time. Because we see this project as a pilot with the potential to engage students in their discipline, we predict it will become a model for other departments that seek to develop curricular models that speak to the objectives of the Quality Enhancement Program.

I appreciate your considering this proposal for funding, and if you need additional information, please do not hesitate to contact me.

The UNIVERSITY of NORTH CAROLINA at CHARLOTTE

V. Project Narrative

A. Specific Aims

1) The **overall purpose** of the project is to improve the oral communication skills of approximately 250 undergraduate electrical engineering students by providing multiple opportunities for practice and feedback.

2) The **project's objective** is to determine whether or not the quality of students' oral presentations improves after post-performance feedback and reflective writing. We will make this determination through a statistical comparison of the control group and the select group of project students.

3) The proposed project will answer the following **research questions**:

   a. Is the level of audience awareness and interaction (aai) higher for the project students than for the control group?

   b. Is the level of message coherence and focus (mcf) higher for the project students than for the control group?

   c. Is the level of message delivery effectiveness (mde) higher for the project students than for the control group?

4) The rationale for the project is partially driven by the Accreditation Board for Engineering and Technology's recent addition of communication standards for accrediting engineering programs (ABET 3). The current research on oral communication in electrical engineering has grown as a result of this development, and the realization that oral presentations are frequently utilized in professional engineering practice. Hence, the UNC-Charlotte ECE faculty has created programmatic student learning outcomes that address the need for students to practice communicating their ideas orally to both professional and lay audiences. To link the project to professional workplace readiness, the design faculty will continue the current practice of asking a panel of local engineers to evaluate the students' final presentations in the second senior design class.

   To plan this project, the ECE design team and the CAC coordinator met twice during the summer of 2011 to develop a standardized analytic rubric for use during the study. We then tested the rubric during a senior design presentation in October 2011 and have revised it to improve its usability.

5) The **impact goal** of the proposed project is the creation of new pedagogy that is more effective in imparting oral communication skills to electrical engineering students in order to prepare graduates for oral presentations required for employability and professional

advancement. The CAC program seeks to use the knowledge gained to assist other departments across campus who seek to improve their students' oral communication skills.

B. Literature Review

Past and current research speaks to the need for a pedagogical shift in the general engineering curricula from a purely technical focus to one that integrates written and oral communication. Darling and Dannels, in "Practicing Engineers Talk About the Importance of Talk," note that there has been a "disparity between the perceived importance of communication" in engineering and the need to provide students with practice and preparation in speaking (2). Currently, scholars and teachers are working with engineering departments to respond to this disparity in a variety of theoretical, curricular, and pedagogical ways. Incorporating public speaking requirements into the curriculum and aligning oral communication assignments with workplace expectations are two examples of this shift (Darling and Danells 2-3). Based on survey and interview data, one recent study concluded that the engineering curricula "make evaluation of oral communication competence a component of grades" and specifically targeted audience adaptation, language use, and style as important criteria in grading communication assignments (Vest et al 41).

Deepening Student Engagement with Oral Communication:

While graduates' workplace readiness is a compelling professional reason for integrating oral presentations, researchers have found that there are intellectual benefits, too. During the development and execution of an oral presentation, student engagement with content deepens as students analyze, synthesize, and create knowledge; thus, they are not merely transferring information (Winsor 223). Furthermore, a study of chemical engineering graduates' workplace preparation noted that one's deep understanding of technical content is reflected in the genre of oral presentations and that "technically sound" presentations, executed by confident engineers, were the most effective (Martin et al 173). Finally, an extensive study of the design presentation in engineering concluded that because students learn how situate new knowledge for an audience and how to negotiate what was legitimate for presentation, the use of oral presentations in the classroom had "clear epistemological implications far beyond the realm of delivery" (Dannels 166).

Using Rubrics to Improve Student Presentations:

Since we will be employing a standardized rubric to capture data, we also researched the use of rubrics in higher education as tools to communicate performance targets to students. The research reflects that rubrics assist students in setting performance goals, while helping them make specific revisions to reflect improvement (Reddy et al 437). In a study conducted in a Business Management course, Petkov and Petkova discovered that the mean percentage

grade for the section that used rubrics in oral presentations was higher than the comparison group (505).

C. Methods

The sophomore, junior, and senior design classes are required for all electrical engineering students, and each course requires student teams to give oral presentations about their design projects. The sophomore design class has an enrollment of approximately forty-five during the spring semesters. Students are divided into design teams of three. Each team is required to design a product to satisfy specific end-user needs, and each team is required to give three oral presentations with these three elements included:

- product design specifications

- conceptual designs

- detailed design/product demonstration

We will divide the sophomore design class into two groups: a project group and a control group, with similar profiles in terms of ethnic, gender, and GPA diversity. To answer the three questions posed in Section A, the following student learning outcomes (SLO) will assess competencies believed to be essential for effective oral communication skills:

SLO. a) Students will demonstrate an awareness of the audience's background knowledge and expectations by fielding questions and interpreting information in a way that is appropriate to the specific audience, be it the general public, an industry representative, or their academic peers.

SLO. b) Students will organize and focus technical material and graphics to deliver a coherent message about the new knowledge they have synthesized and produced.

SLO. c) Students will be able to deliver the presentation in an audible voice, with minimum use of notes and filler words.

The levels of achievement of these outcomes by the project students will be statistically compared with those by the control group, using direct assessment data from the four design courses. Table 1 summarizes the assessment method used. It shows the selected courses for each SLO, the metrics used to determine the levels of achievement of the SLO, and the statistical variable names to be analyzed in the evaluation phase.

To score the students we will use the analytic rubric shown in Table 2. This rubric was developed by the Electrical Engineering design faculty in collaboration with the Communication Across Curriculum (CAC) coordinator. The Electrical Engineering design faculty drafted the rubric during the May 2011 CAC Institute, and then rewrote and revised it during two meetings

in July 2011 with the CAC coordinator. In October 2011 we conducted a usability test during the senior design presentation class, and then revised the test rubric to make it less cluttered, and thus more user friendly for scoring during live presentations.

The local industry engineers who will evaluate the students' final presentations will not be informed of who the project students are, since they represent the audience with whom our graduates will have to communicate. In addition, they are unbiased because they have no stake in the outcome of the study. Therefore, the conclusions of the study will be more accurate if the rubric scores awarded by the industrial panel members are weighted more heavily than the scores from the course instructors. This will be done by repeating each score from the panel members five times in the data set; giving their judgment five times more weight in determining the outcome of the statistical study.

Table 1: A Summary of the Assessment Method

Student Learning Outcome	Courses used for Assessment		Metrics Used	Statistical Variable Name used
SLO.a	Sophomore Design Junior Design Senior Design I Senior Design II	(ECGR2252) (ECGR3157) (ECGR3253) (ECGR3254)	Scores from rows 1 & 2 of the Analytic Rubrics	aai
SLO.b	Sophomore Design Junior Design Senior Design I Senior Design II	(ECGR2252) (ECGR3157) (ECGR3253) (ECGR3254)	Scores from rows 4 & 7 of the Analytic Rubrics	mcf
SLO.c	Sophomore Design Junior Design Senior Design I Senior Design II	(ECGR2252) (ECGR3157) (ECGR3253) (ECGR3254)	Scores from rows 3, 5 & 6 of the Analytic Rubrics	mde

Table 2: Analytic Rubric Used to Collect Data

ECGR xxxx: "Course Title"& Semester

Team _____   Evaluator _____

Category	3. Excellent	2. Satisfactory	1. Deficient	Score (1-3)
1. Awareness of the audience's needs and expectations	**a.** Demonstrates *excellent* awareness of audience's background knowledge & needs **b.** Dresses appropriately	**a.** Demonstrates *adequate* awareness of audience's background knowledge and needs; **b.** Dresses suitably	**a.** Demonstrates *lack* of awareness of audience's background knowledge and needs; **b.** Dresses inappropriately	
2. Interaction with audience	**a.** Engages the audience with enthusiasm for the topic **b.** Handles Q&A by answering questions with explanations & elaboration	**a.** Engages the audience with some enthusiasm **b.** Handles Q&A with adequate explanations	**a.** Rare engagement with the audience **b.** Lacks knowledge to successfully conduct Q&A	
3. Visual and graphic representation of ideas	**a.** Uses superior visuals / graphics frequently to facilitate message delivery	**a.** Uses *acceptable* visuals/graphics *at times* to facilitate message delivery	**a.** Use of *weak* visuals/graphics detract from message delivery	
4. Focus and arrangement of ideas	**a.** Focuses presentation by providing context **b.** Sequences ideas in a logical, engaging way **c.** Includes a compelling introduction **d.** Concludes presentation appropriately	**a.** Provides *some* context to focus presentation **b.** Acceptable sequence of ideas **c.** Includes a suitable introduction **d.** Adequately concludes presentation	**a.** Fails to focus presentation by omitting context **b.** Neglects to sequence ideas **c.** Lacks a strong introduction **d.** Lacks a satisfying conclusion	
5. Delivery: Projection Pacing Elocution Eye Contact Filler word	**a.** Consistently uses a clear, audible voice **b.** Effective pacing **c.** Maintains eye-contact with audience **d.** Rarely reads from notes/slides; **e.** Minimal use of filler words: um, uh, like, well, etc.	**a.** Uses a *mostly* clear, audible voice **b.** *Sometimes* pace is too fast or too slow **c.** Makes *some* eye contact with limited group within audience **d.** *Sometimes* reads from notes/slides **e.** Uses *some* filler words	**a.** Frequently uses an unclear, inaudible voice **b.** Pace is uneven: usually too fast or too slow **c.** Makes little or no eye contact **d.** Relies on or reads from notes too often **e.** Filler words interfere with expression	
6. Time	**a.** Adheres to time limit	**a.** Exceeds or under time limit by <20% of the allocated time	**a.** Short presentation or exceeds time limit by >20%	
7. Quality of technical content	**a.** Presents technical content and context clearly and accurately **b.** Uses proper, accurate references	**a.** Presents technical content and context satisfactorily **b.** Uses *adequate* references	**a.** Lack of technical content and context **b.** Fails to use proper, accurate references	

Evaluator's Comments: Total

D. Evaluation

For each SLO, we will collect samples by aggregating each project student's rubric score from all the courses used for the assessment of that SLO. The same method will be employed for the control group students. For the project student samples, we will refer to the variables *aai*, *mcf*, and *mde* as *aai_project*, *mcf_project*, and *mde_project*. For the control student samples, we will refer to the variables *aai, mcf,* and *mde* as *aai_control, mcf_control*, and *mde_control*. We assume that the standard deviations of the two populations (project and control) are equal and three Pooled t-Tests [3] will be conducted to test the following hypothesis for each pair of variables such as *aai_project* and *aai_control*:

$$H_0 : \mu_1 \leq \mu_2$$

$$H_1 : \mu_1 > \mu_2$$

With a 0.05 level of significance, the p-values are used to make inferences about the population means μ_1 and μ_2 in each of the four tests.

Depending on the results of the t-tests, one of three possible conclusions will be reached for each SLO:

- there is strong evidence to support that written feedback and students' reflective writing on their videotaped presentations is effective in improving the tested competency related to oral communication.

- there is strong evidence that it does not improve the tested competency.

- there are inconclusive results of the study with respect to the specified competency.

E. Knowledge Dissemination

All project faculty will participate in authoring/co-authoring and submission of scholarly publications to education research journals and conferences. We have submitted a poster presentation abstract to the Liberal Education division of the American Society for Engineering Education's 2012 Annual Conference and Exposition are awaiting the panel's decision. We will also share preliminary findings at the May 2012 Communication Across the Curriculum Summer Institute at UNC-Charlotte. And we plan on presenting the results at a CAC Lunch and Learn event in the fall of 2012. Examples of other possible publication venues include the American Society for Engineering Education's annual conference proceedings, the American Journal of Engineering Education, and the IEEE Transactions on Education.

F. Human Subjects

We have discussed our project with Cat Runden in the IRB office and have been advised to apply for a waiver of consent since the research will happen in an existing instructional and pedagogical context. We will submit the waiver by November 30, 2011.

G. Extramural Funding

We are seeking funds from the SOTL grant to fund the implementation expenses of the first year of this project. For the second year, the CAC program will fund the cost of a graduate teaching assistant, who will collect and track data.

H. Timeline

The chronological implementation plan outlined below begins in the spring 2012 sophomore design class and concludes at the end of the fall 2013 semester, when senior teams present to the industry panel. This timeline enables students to: develop oral presentations, schedule and collect assessment data, receive feedback and reflect on their presentations. It also builds in time for the design faculty and TAs to analyze statistical data to answer the research questions.

Spring 2012 (sophomore design class): Select the project and the control group students, schedule three oral presentations for each student team, and obtain the project students' agreement to be videotaped:

- Divide the sophomore design class into project group and the control group students with similar composition in terms of ethnicity, gender, and GPA diversity (Miri).
- Schedule three oral presentations for each team on 1) design specifications, 2) conceptual designs, and 3) detailed design/project demo (Miri).
- Hire a TA to help with videotaping and collection of assessment data (Miri).
- Provide project students with written feedback via the Analytic Rubrics (Miri)
- Set deadlines for project students' viewing and critiquing their videotaped presentations (Miri).

Summer 2012: Streamline the assessment and evaluation process:
- Learn from the sophomore design data collection experience and streamline the process of data collection and compilation into statistical variables (Miri and TA).
- Identify the statistical tools needed for data analysis (Miri and TA).
- Organize and attend a half-day retreat to discuss, improve, and practice the streamlined process (BouSaba, Coco, Conrad, Cox).

Fall 2012 (junior design class): Schedule three oral presentations for each student team and continue to collect assessment data and to provide feedback:

• Schedule three oral presentations for each team on 1) design specification, 2) conceptual designs, and 3) detailed design/project demo (Cox).

• Provide project students with written feedback via the Analytic Rubrics (Cox)

• Set deadlines for project students' viewing and critiquing videotaped presentations (Cox).

• First year progress report due Dec. 2012 (all).

Spring 2013 (senior design I): Schedule oral presentations for each student team and continue to collect assessment data and to provide feedback:

• Schedule each team's oral presentations (BouSaba).

• Provide project students with written feedback via the Analytic Rubrics (BouSaba, Conrad)

• Set deadlines for project students' viewing and critiquing their videotaped presentations (BouSaba, Conrad).

Fall 2013 (senior design II): Schedule the final oral presentations to the industry panel, analyze all collected data and test the three hypotheses:

• Schedule each team's oral presentations to be given to industry panel (BouSaba, Conrad).

• Collect the industry panel's assessment data and include in the six samples for the t-tests (BouSaba, Conrad)

• Conduct the t-tests and publish the results in the project report (all).

Works Cited

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