

## **AC 2010-713: IMPROVING THE ABILITY OF ENGINEERING STUDENTS TO COMMUNICATE TO NON-TECHNICAL AUDIENCES**

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### **Susan Metz, Stevens Institute of Technology**

Susan Metz is the senior advisor for the Center for Innovation in Engineering and Science Education at Stevens Institute of Technology. As a founder and president (1997 – 2002) of WEPAN, Women in Engineering Proactive Network, Susan has worked with over 200 colleges and universities to increase access and engagement of women in engineering and science through research, policy and program development. She is currently the principal investigator for ENGAGE, Engaging Students in Engineering, ([www.engageengineering.org](http://www.engageengineering.org)) a five year project funded by the National Science Foundation to work with 30 engineering schools to integrate research based strategies that increase retention. Susan's work at Stevens has been recognized by the White House as a recipient of the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM). She was honored by the Maria Mitchell Association with the Women in Science Award in 2002 and was named an AWIS Fellow in 2007.

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David Silverstein earned his MFA in Creative Writing from the Pennsylvania State University, and has undergraduate degrees in English and psychology from Cornell University. He served as a full-time lecturer at PSU, teaching several writing courses. He has helped to coordinate writing tutorial programs at PSU both and Stevens Institute of Technology, where he now directs the Writing and Communication Center. Additionally, he has worked as a technical writer in both the high-tech and financial fields and has been awarded an Academy of American Poets prize. His work has appeared in several journals, including The Amherst Review, The New School's LIT Magazine and Pank. He previously worked as a technical writer for a market research firm.

# Improving the Ability of Engineering Students to Communicate Their Technical Discoveries to Non-Technical Audiences

## Abstract:

*The Engineer of 2020* identifies the ability to communicate as a key attribute of successful engineers. ABET requires engineering schools to ensure students' ability to communicate effectively upon graduation. Yet traditionally, the ability to communicate has been interpreted narrowly, simply requiring students to convey technical information to their professors or peers. Stevens Institute of Technology, through its Writing and Communications Center, offers a sequence of workshops to undergraduate engineering students in their junior and senior years designed to develop and strengthen students' oral and written presentation skills. The Engineering Information Foundation (EIF) provided funding to Stevens to improve existing support for students by developing and assessing workshop components to increase students' ability to communicate research to non-technical audiences. Modifications to the workshops were made based on pre- and post-survey data. Furthermore, the grant was used to develop and award a Communication Prize. Typically, Stevens, awards a prize to two senior design project student teams for innovative design, research or business projects which could lead to the development of a technology directly linked to either novel or established scientific concepts. The EIF grant offered the opportunity to award an additional prize for the senior design team that developed the most compelling presentation to non-technical audiences. This essay provides specific information about the workshop content and Communication Prize criteria, student assessment and faculty response to the project.

## Introduction:

That engineers' ability to communicate with a variety of audiences is crucial to their success seems widely if tacitly accepted. For example, *The Engineer of 2020*, a report by the National Academy of Engineering (NAE) points to engineers' engagement with "multiple stakeholders – government, private industry, and the public" and remarks, "The increasing imperative for accountability will necessitate an ability to communicate convincingly and to shape the opinions and attitudes of other engineers and the public."<sup>1</sup> Further, *In Raising Public Awareness of Engineering*, the NAE concludes that the need to improve public awareness about engineering among an array of lay audiences is considerable. Elected representatives are ill-equipped to make decisions about technology-related issues, and students, parents and teachers remain uninformed about engineering and the contributions of the field which continues to deter students from studying engineering.<sup>2</sup> The American Association for the Advancement of Science (AAAS) summarizes these issues compellingly: "Scientists and engineers who foster information-sharing and respect between science and the public are essential for the public communication of and engagement with science. ... [T]raditional scientific training typically does not prepare scientists and engineers to be effective communicators outside of academia."<sup>3</sup> The AAAS, the NSF and other organizations have begun to respond to this need through a variety of means. Engineering

education must, too. To that end, the authors of the current paper received funding from Engineering Information Foundation to study and enhance efforts already underway at Stevens Institute of Technology Institution to better prepare engineers to communicate with lay audiences. The current essay traces the development and implementation of improvements to communications workshops offered to engineering students to help them communicate more effectively with lay audiences in light of assessment of an existing workshop series.

### **Background:**

For more than a decade, all Stevens' students have been required to take 4 communication-intensive courses in the freshman/sophomore years as part of the undergraduate curriculum. These courses in all the humanities each require six short essays and a variety of oral presentations. In addition, for the past two years, the Writing and Communications Center (WCC) has been offering workshops to undergraduate engineering students to improve their written and oral presentation skills.<sup>4</sup> These workshops were added to senior design classes in response to the needs of the engineering school. This grant-funded project supported the development of additional workshop components to enhance the communication skills of students when they presented their findings and projects to non-technical audiences. Grant money has also been used to establish a prize for the best presentation of a senior design project to a lay audience.

The three-semester period of the grant – Spring '09 , Fall '09 and Spring '10 – has not yet been completed, so data included in the this study are current to December '09. It should be noted that all stakeholders are pleased with the improved workshops which will continue to run in future years, and assuming in-house funding, will be continuously assessed with an eye towards continuous improvement.

Workshops typically range from 60 to 120 minutes, with an average of 8 to 10 workshops per any given semester. Class sizes are often around 24 students (though some range upwards of 75 students depending on engineering discipline enrollment) and all workshops include MS PowerPoint slides, handouts, and student exercises. The first series of the revised workshops was conducted in the spring of 2009, with one hundred twenty-seven (127) students participating. Note: some instructors opt to have only fall workshops to help jump start students' senior design projects.

In Spring and Fall 2009, there were 8 separate workshops each semester. The disciplines (and number of workshops) were as follows:

- Spring 2009: biomedical (4), electrical (2), computer engineering (2).
- Fall 2009: biomedical (2), electrical (1), computer (2), mechanical (1), and civil (1), chemical engineering (1).

All workshops conducted during the grant period were facilitated by the same staff member, David Silverstein, who has experience in academia and industry teaching communication skills and running tutoring programs and focus groups.

Participation in the communications workshops is voluntary, but strongly endorsed by the deans of engineering responsible for oversight of curricula. Moreover, the workshops have developed a loyal following among senior design instructors. Stevens' engineering curricula all include a "design spine" that runs the four years of undergraduate instruction. The culmination of the design experience is a year-long senior design project presented to the public on Senior Design Day. The communications workshops were positioned to remind seniors that solving engineering problems is necessary but not sufficient to the practicing engineer. Without clarity of expression, engineers risk losing their labor if they cannot effectively and successfully communicate with their audiences.

### **Contents of the workshops:**

The WCC workshops, which have been offered at Stevens Institute of Technology since Spring 2007, focus on the following main areas: audience, rhetorical appeal, technical writing concerns, formal report structures, transmitting data using visual aids, and other presentation considerations.

Audience awareness includes making students aware that the same information will often be presented to different cohorts. Students are reminded to ask themselves questions such as:

- Why are you giving this presentation?
- What is your goal?
- Who is your audience?
  - How technically informed are the audience members?
  - Are you speaking to colleagues, superiors or people from an entirely different area?
  - How large is your audience?

Students are cautioned about time management skills – neither rushing nor running over – as well as the utility of arriving early to troubleshoot any setup, and the necessity of budgeting time for questions. Some workshop time is spent on the Aristotelian rhetorical triad of *ethos*, *pathos* and *logos* – the three main persuasive modes – and the relationship between the speaker and the audience engendered by the presentation.<sup>5</sup> Technical reporting concerns such as avoiding jargon, using appropriate idioms and using the right mix of specific details and general language are addressed. Specific reports such as research papers and feasibility studies are included based on the instructor's wishes. Quite a bit of time is also devoted to how to present data graphically and the balance of words and images?

For example, basic strategies such as what kind of chart best conveys data are contrasted:

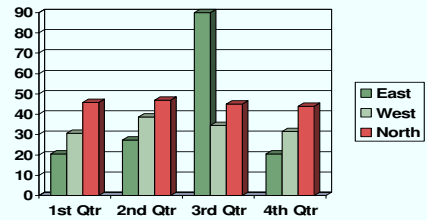
## Graphs v. Charts

Which illustrates the implications faster?

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
East	20.4	27.4	90	20.4
West	30.6	38.6	34.6	31.6
North	45.9	46.9	45	43.9

This chart?

## Graphs v. Charts



Or this graph?

and

## Visual Displays – Examples

What's more interesting?

***Chrysaora fuscescens*** (sometimes generally referred to as the Pacific sea nettle or the West Coast sea nettle) is a common variety of true jellyfish, found in the Pacific Ocean mostly near the coast from California to Alaska (perhaps also to Japan).

Diameter of the body (the "bell") can be greater than 1 meter, although most are less than 50 cm across. The long, complicated, spiraling oral arms and the 24 tentacles may trail as far as 3.6 to 4.6 meters behind the bell.

## Visual Displays – Examples

What's more interesting?

***Chrysaora Fuscescens***<sup>\*</sup>  
aka: Pacific Sea Nettle, West Coast Sea Nettle



<sup>\*</sup>Located in the Pacific near California and Alaska ( & perhaps Japan).

What works for one audience may not work for another:

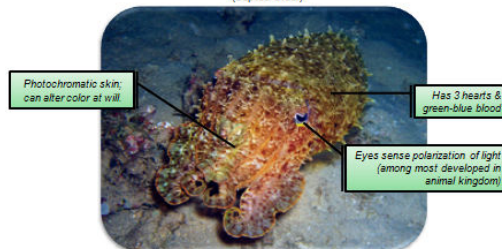
## Visual Displays – Examples



- Cuttlefish:**
- Marine animals
  - Order = Sepiida
  - Photochromatic skin alters color at will
  - Eyes perceive polarization of light (among most developed in animal kingdom)
  - 3 hearts; green-blue blood

## Visual Displays – Examples

**CUTTLEFISH**  
(Sepiida Order)



Finally, physical considerations such as eye contact, breathing, and pace are addressed.

## **Workshop evaluation:**

An evaluation of the WCC workshops was conducted by an experienced external evaluator. To gain an understanding of the workshops' impact on participants, surveys sampled response to two issues:

- Students' confidence in their ability to communicate effectively.
- Students' awareness of their need as engineers to communicate to broad audiences.

The questions are included in Tables 1 and 2 below.

Students completed an on-line version of the pre-survey and a paper version of the post-survey. The paper version was implemented to improve survey response rates because student participants were not responding to the online post-survey at the rate that they had for the pre-survey. The paper survey was conducted in the classroom as opposed to the asynchronous on-line survey.

## **Findings: surveys**

The findings from the pre- to post-survey indicate that the workshops were indeed effective in making students more aware of the necessity and the value of making technical concepts clear to broad audiences. One set of questions addressed students' ranking of their own abilities on a scale of "Excellent Ability," "Some Ability," and "No Ability." The number of respondents who rated themselves as having excellent ability increased in all categories from the pre- to post-survey results. (The only exception was an insignificant decrease, particularly insignificant given the low response rate, for question 3).

Respondents who selected "Excellent Ability" increased in percentage from the pre- to post-surveys in three questions relating directly to the objective of communicating technical concepts to non-technical audiences – their ability to:

- Write a document that effectively explains a complex technical topic moved from 30% to 42%.
- Describe a technical design so that a non-technical person can describe it to someone else rose from 22% to 38 %.
- Develop a speech or paper effectively for a specific audience (e.g., reporters, politicians, school children, etc.) went from 17% to 33%.

The last question was one for which respondents who rated their ability as "some or no" also increased (from 23 to 28%), indicating that while some respondents gained confidence as a result of the workshop, others experienced decreased confidence. Respondents also showed a decrease in confidence in their ability to "Keep an audience engaged in a speech that [they] give" (from 30% to 35%). In all other questions, the number responding at some or no ability either stayed the same or decreased.

**Table 1: Responses to Ability Questions<sup>6</sup>**

How would you describe your ability for each of the items listed below?	Excellent Ability				Good Ability				Some to No Ability			
	Pre-Survey		Post-Survey		Pre-Survey		Post-Survey		Pre-Survey		Post-Survey	
	# Resp.	%	# Resp.	%	# Resp.	%	# Resp.	%	# Resp.	%	# Resp.	%
1. Write a speech that effectively explains a complex	12	17%	5	22%	41	57%	14	61%	19	26%	4	17%
2. Write a document that effectively explains a complex	20	30%	10	42%	39	58%	13	54%	8	12%	1	4%
3. Keep an audience engaged in a speech I give.	16	22%	5	21%	35	48%	11	46%	22	30%	8	35%
4. Describe a technical design so that a technical person can describe it to someone else.	22	31%	8	33%	37	52%	12	50%	12	17%	4	17%
5. Describe a technical design so that a non-technical person can describe it to someone else.	16	22%	9	38%	39	54%	10	42%	17	23%	5	21%
6. Speak clearly and effectively.	21	29%	11	46%	34	47%	11	46%	17	23%	2	8%
7. Write clearly and effectively.	15	23%	16	67%	39	61%	7	29%	10	16%	1	4%
8. Understand which jargon or technical terms are understood by non-technical audiences.	19	26%	6	25%	39	53%	13	54%	16	22%	5	21%
9. Develop a speech or paper effectively for a specific audience (reporters, politicians, school children, etc.).	12	17%	8	33%	42	60%	7	29%	16	23%	9	38%

Student responses to questions which fell in the “some to no” ability category help identify areas for greater emphasis in future offerings of the workshop. As shown in Table 1, one fifth of students responded “some to no ability” to questions 1, 4, 5, and 8, (all of which relate directly to the WCC objectives to improve ability to communicate with lay audiences). More than one third (38%) of respondents indicated “some to no” ability for question 9, (designed to determine projected practice). Moreover, for question 3 (which measures student confidence to keep an audience engaged), one third (35%) responded “some to no” ability. All these responses reinforce the need for interventions to assist students with communication skills by means of a workshop or class at the same time that they indicate an opportunity to improve the current workshop.

A second set of questions was designed to measure respondent understanding of the value of communicating technical concepts. Students’ responses show an overall gain among those who chose “strongly agree” or “agree” for all questions. It is interesting to note that for the second and third questions, the number of respondents who “strongly agreed” dropped and those who “disagreed” with all three statements increased. Although the small number of post-intervention responses prohibits us from drawing conclusions from this shift, it does offer valuable feedback for the workshop coordinator and points to a need for possible qualitative follow up.

**Table 2: Value of Technical Communication**

	Strongly agree		Agree		Disagree	
	Pre	Post	Pre	Post	Pre	Post
Being able to describe my technical work effectively is a necessary professional skill.	62%	96%	35%	--	--	4%
Being able to describe my technical work effectively affects my career advancement.	54%	13%	43%	83%	--	4%
It is the responsibility of engineers to communicate technical concepts to people who do not have technical backgrounds or education.	58%	32%	2%	50%	1%	4%

The surveys also had direct, formative, open-ended questions.

In the pre-survey:

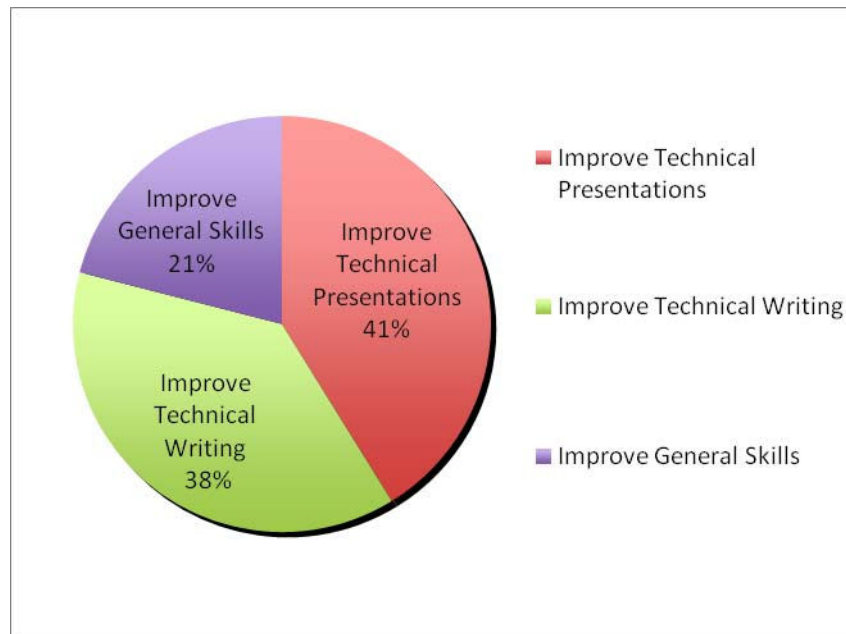
- List three skills that you want to develop in the current WCC Workshop.

In the post-survey:

- Name the three things that you did differently when preparing a presentation or report as a result of taking this workshop.

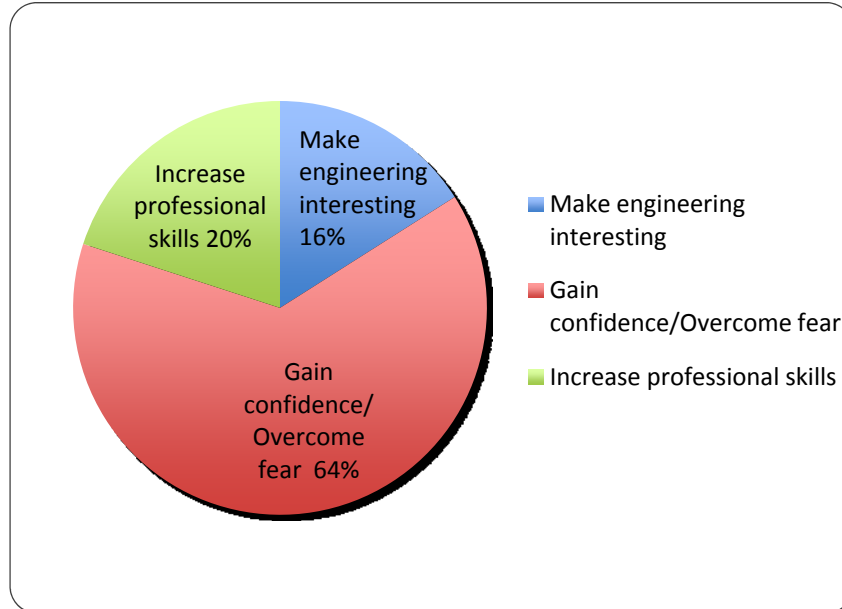
The responses to the question in the pre-survey fell into three categories: Improving Technical Presentations (41%); Improving Technical Writing Skills (38%); and Improving General Skills (21%) (See Figure 1).

**Figure 1: What students want to get out of the workshop**





**Figure 2: Items in “Improve General Skills” (Cited in Figure 1)**



The “Improve General Skills” category represented in Figure 2 includes gaining confidence or overcoming a fear of presentations (64%); increasing professional skills (20%); and making engineering interesting to others (16%). These results are a solid endorsement of paying additional and focused attention to improving the communication skills of undergraduate engineering students.

In response to the question, “Name the three things that you did differently when preparing a presentation or report as a result of taking this workshop,” the majority of respondents (74%) cited specific advice from the presentations workshop to improve the look and clarity of their slides such as careful selection of fonts and graphics; use of succinct text; and proofreading slides. 16% of respondents offered more global concepts such as “how to express technical concepts to a broader audience” and 10% to “appearing more confident.”<sup>7</sup>

### **Changes in the workshop series:**

The evaluation of the Spring 2009 WCC Workshops provided information which led to a number of changes in the Fall 2009 WCC Workshops. Originally, there were two workshops before the EIF grant: (1) Presentation Techniques and (2) Technical Writing Considerations. There are now four main workshop modules as part of the WCC Workshop series:

- 1) Introduction to Technical Writing Considerations
- 2) Advanced Technical Writing Strategies
- 3) Introduction to Presentation Skills
- 4) Advanced Presentation Skills and MS PowerPoint Features

Design spine instructors have the choice of which workshops are offered, and consult with David Silverstein to select a workshop that meets their current needs. Moreover, additional workshops and workshop modules are already in the works and available to the community-at-large as well as to future senior design classes. Titles of the workshops being piloted in Spring 2010 include:

- The Writing Process: How to Organize Your Thoughts
- Writing Abstracts, Introductions, and Conclusions
- Business English for ESL/ESOL Students
- Citing and Summarizing Outside Sources for ESL/ESOL Students

Specific changes in the content of the WCC Workshops included the addition of the following specific modules for students:

- How To Tell A Story With Your Information
- How To Alter Your Messaging for Various Audiences.

The "how to tell a story" module focuses first on understanding how one's audience will interact with the information presented (e.g., will the audience apply these ideas, use this item, or buy this service) and then on learning to "spin a story" out of that interaction. Students learn that storytelling is a significant human mode of interaction that can package information into memorable and transferable units connected throughout by coherent narrative. Examples are provided that illustrate presenting information with and without a narrative. Three slides on speaking about color blindness offer great technical detail and no graphics (Slide 1), the opportunity for personal narrative (Slide 2), and pared down information with illustrative graphics (Slide 3) – demonstrating to students the need to understand how audiences process information.


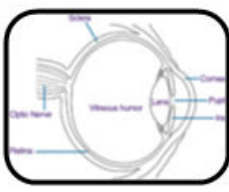
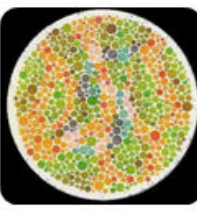
## Storytelling: Color Blindness

**Color Blindness:**

- 1 in 12 people have some sort of color deficiency
- About 8% of men and 0.4% of women in the US
- Four kinds of color vision:
  - **Trichromat:** Regular vision is Trichromatic - it uses all three color receptors (red/green/blue). In practice, the **cone cells** in your eyes are called L, M and S (for long, medium and short wavelength reception), but the colors they 'see' are closer to Yellow, Green and Blue. The wavelengths they pick up are vastly overlapping, so green light hits all three in varying degrees.
  - **Anomalous Trichromat:** People with Anomalous Trichromatic vision use all three color receptors but reception of one pigment is misaligned.
  - **Dichromat:** People with Dichromatic vision use only 2 of the 3 visual pigments - red, green or blue is missing.
  - **Monochromat (Achromatopsia)**

(Slide 1)


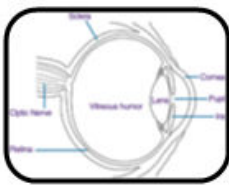
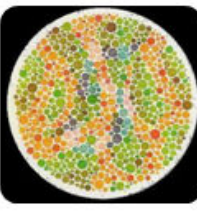
## Storytelling: Color Blindness

*When I was 14...*

(Slide 2)

## Storytelling: Color Blindness

- 1 in 12 people → 8% men, 0.4% women (US)
- 4 Types → *Trichromat*: overlapping pigments  
*Anomalous Trichromat*: 1 pigment misaligned  
*Dichromat*: only use 2 of 3 visual pigments; 1 missing  
*Monochromat*: only 1 pigment; 2 missing


(Slide 3)

Other specific changes in the content of the WCC Workshops with regard to messaging include the following.

- 1) Slides were included to reflect the ways various companies rephrase or reposition similar information for different audiences (e.g., less and more technically minded cohorts). Slides 4 and 5 on Fermilab below target respectively a general or lay audience, and physicists seeking information about Fermilab. Using more vs. less technical detail, different graphics, and different levels of diction are highlighted. Specifically discussed were the greater use of familiar images and keywords for lay-

audiences, and the higher level of diction as well as appropriate use of jargon, acronyms, footnotes, embedded links, and references for technical audiences.

## Different Audience/Approach



The screenshot shows the Fermilab homepage with a navigation menu on the left and a main content area. A callout box points to the 'Home' link in the menu. Another callout points to a featured article titled 'Superconducting Technology, Chicago Style'. A third callout points to a 'Fermilab Today' news item. A fourth callout points to a 'For Our Neighbors & Visitors' section. A fifth callout points to a sidebar link 'A proton-antiproton collider in Batavia, Illinois'. A sixth callout points to the featured article's image, which includes a hot dog and a sandwich.

A proton-antiproton collider in Batavia, Illinois


Colorful & accessible image of familiar items

Easy to understand & well-organized links to find further info

Material written for a general, lay audience

(Slide 4)

## Different Audience/Approach



The screenshot shows the 'International Services' page on the Fermilab website. It features a sidebar with 'User Office' and 'Alerts' sections. The main content area contains text about international services and a 'User Office' section. Callouts point to the 'User Office' section, the 'Alerts' section, and the main text. A callout points to the 'User Office' section, which includes photos of staff members. Another callout points to the 'Alerts' section, which includes a link to 'More Information'. A third callout points to the main text, which includes a link to 'More Information'.

Same organization, but now 'for physicists'

Specialized links to further info

Fewer images; greater focus on key information

Material written for a technical audience

(Slide 5)

- 2) Students participated in a short exercise that asks them to identify jargon in a piece of writing and convey the information contained in it to different audiences. For example, how would a student describe his/her major to a friend? To a professor? To a parent? To an employer? Or how would a student describe the most complicated course concept of the past semester to a younger sibling? To an employer? Techniques for "translating" jargon, defining acronyms and weaving additional information into a less technical message were also discussed during this activity.
- 3) Print copies of the surveys were distributed at the end of each workshop to improve the response rate – rather than relying on emailed survey links to an asynchronous on-line forum.

One additional and apparently significant change was made that did not appear in the formal evaluation that is worth noting. As part of each workshop, students are encouraged to seek additional resources at the Writing and Communication Center (WCC) at Stevens Institute of Technology. One of the key changes made was to refer to the WCC staff as “writing and communication specialists” – not “tutors.” Previously, when students came to the Writing Center, staff would ask if the students wanted to meet with a tutor. A frequent student response was: “No, I don’t need a tutor. I just want to know if someone could help me with this project.” It appears that students do not like to view themselves as deficient, and the term “tutor” connotes remediation. Therefore, just as the WCC workshops instruct students to tailor or adjust their message for different audiences, the WCC has changed its message to suit its audience. Undergraduate student visits to the WCC have *tripled* this semester from approximately 38 student visitors in Fall 2008 to 143 in Fall 2009, taking, therefore, fuller advantage of WCC offerings.

### **Fall 2009 evaluation:**

There were approximately 200 students who participated in the revised Fall 2009 WCC Workshops. Students were asked the following three questions:

- Would you recommend that this WCC Workshop be offered to all engineering students?
- Name the three things that you did differently when preparing a presentation or report as a result of taking this workshop.
- Tell us what you would do to improve the WCC Workshop.

Of 102 responses, an overwhelming 95% said they would recommend the workshop be offered to all engineering students. Workshops are currently made available to all engineering faculty who teach the junior and senior design courses in semesters six, seven and eight. However, including the workshops in any given class (although endorsed by the administration of the engineering school) is voluntary for individual faculty.

In response to the question, “Name the three things that you did differently when preparing a presentation or report as a result of taking this workshop,” students identified 57 items that can be divided in two broad categories: 1) preparing a PowerPoint presentation and 2) giving an oral

presentation. Specific comments in these categories highlight the improvements students planned to make:

**Preparing a PowerPoint Presentation:**

- Use professional templates.
- Proofread documents.
- Have less clutter on slides.
- Be direct and clear when writing and creating slides.
- Keep audience in mind.

**Giving an Oral Presentation:**

- Practice the presentation with some friends prior to the presentation.
- Test the PowerPoint on a projector prior to the presentation.
- Interact with the audience.
- Slow down when speaking.
- Explain technical terms.
- Focus on different ways to communicate with different audiences.
- Avoid note cards.
  - Know slides well enough to speak from them.

In response to the question “Tell us what you would do to improve the WCC Workshop,” there were a number of interesting responses including:

- Give the workshop to freshmen engineering students.
- Focus on how to practice giving a presentation.
- Have groups give presentations and get critiques from different audiences.
- Provide more practical advice or tactics on how to get yourself out trouble during a presentation (recollect yourself).
- Make the workshop a full course on professional communications for engineers.

The authors of this paper note in response to this last observation that Stevens Institute of Technology does offer such a course at the graduate level which is open to juniors and seniors in good standing, and will provide relevant stakeholders in curriculum development with this and other student reactions to the WCC workshops. However, if a communications course is optional, many students might opt out rather than risk a poor grade.

**Technical Communications Prize:**

In order to enforce the importance of clarity in presentations, and to generate interest among students, a competition was held and prize offered to the senior design team best able present its project to a lay audience. Instructors for all senior design areas were invited to submit one team per discipline and instructed to select not necessarily the best design project but rather the team best able to convey its results. Instructors asked to nominate a senior design team in their disciplines based on the following criteria, bearing in mind that the team would be judged on their ability to communicate technical ideas to lay audiences – not on technical content.

- Organization and development
- Delivery
- Use of slides (5 slides max)
- Content

Students received the same information. The Stevens community at large was invited to attend this competition, which was held at the end of Senior Design Day, the day that all teams formally present their projects to the public. A panel of three judges was assembled – all non-engineers. The panel consisted of the dean for undergraduate student life, the director of the career development office (i.e., job placement) and the Stevens writing director, (co-author of this paper) – all chosen for their familiarity with the entire student body, and the needs of graduates to write and present professionally.

Students were judged according a rubric developed locally but based on existing communications assessment rubrics already in use at Stevens Institute of Technology. The judges assigned up to 10 points in each of 4 categories – organization and development, delivery, use of slides, and content – and the rubrics tabulated on the spot. The winning team received award letters and certificates, and shared a \$500 prize.

Students, both participants and audience, offered many spontaneous positive comments on the competition. Having to speak in public to wider audiences than their own classes and having the opportunity to see their friends make presentations underlined that graduation and the jobs that most of them had already secured were just ahead of them. Starting very shortly, presentations would bring more than certificates and token prizes – or cost more than momentary embarrassment. But in addition to the students' enjoying the competition, perhaps the most salutary result was that the design spine instructors present in the audience were struck that although some students were quite accomplished, some others displayed a distressing lack of skills. The instructors all said they would either continue to have the workshops offered to their classes or begin to do so (that is, instructors who had not yet requested workshops planned to in Fall 2009). The 2010 competition will be announced early in the spring semester to give wider visibility to the efforts of the WCC workshops and student success. The first two years' prize money stemmed from the grant. It is hoped Stevens Institute of Technology will endow future competitions beginning in Spring 2011.

### **Conclusion:**

There is little doubt that engineering students as a group benefit from improving their communication skills. Their improved skills increase their own professional lives as well as the good they can do the community-at-large by communicating more effectively to a spectrum of audiences. Although some students would like to take entire courses in professional communication skills, student enthusiasm can wane in the face of the time and effort needed to create quality papers and presentations. When students' papers and presentations are graded, the results are often not what the students want or expect – even if the net result (improved skills) is important. The addition of communications workshops to engineering curricula is a partial step towards bettering young engineers' skills in a lower-stakes environment.

## References

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<sup>1</sup> *The Engineer of 2020: Visions of Engineering in the New Century*, National Academy of Engineering, National Academies Press, 2004, p. 55.

<sup>2</sup> Davis, L.A. and Gibbin, R.D. (2002). *Raising Public Awareness of Engineering*, National Academy of Engineering, Washington, D.C., p. 1.

<sup>3</sup> <http://communicatingscience.aaas.org/Pages/newmain.aspx> - retrieved January 5, 2010.

<sup>4</sup> Formerly the WCI – Writing and Communication at the Institute program, was an umbrella that covered all communications sources and support programs, and was directed by Deborah Sinnreich-Levi. WCC, directed by David Silverstein, now a full-time staff member, covers support programs such as workshops, tutoring and conversation groups, while academic writing programs remain under the direction of Prof. Sinnreich-Levi, tenured faculty.

<sup>5</sup> *Ethos* is rhetoric whose strength stems from the moral character of the speaker. *Logos*' power is derived from logical argument. And *pathos* is based in emotional appeal. The terms originate in Aristotle's *Rhetoric* Book I, Chapter 2. See, for example, Aristotle.(1984) *The Complete Works of Aristotle: The Revised Oxford Translation*. Ed. and tr. Jonathan Barnes. Bollingen Series 71:2. Princeton University Press.

<sup>6</sup> Note that all percentages are rounded to the nearest whole number.

<sup>7</sup> Percentage of responses in this question indicates the total number of answers (respondents could provide three each), rather than total respondents.

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Aristotle.(1984) *The Complete Works of Aristotle: The Revised Oxford Translation*. Ed. and tr. Jonathan Barnes. Bollingen Series 71:2. Princeton University Press.

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