# Incorporating design into class teaching technical communication skills

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## ABSTRACT

A technical writing class is a perfect vehicle for giving students the opportunity to be creative designers and to learn more about the engineering profession as well.

In order for our students to have more experience in brainstorming, teamwork, and product development, we have incorporated into our technical communication class participation in Suffolk University's Business School's New Product Innovation Competition. Students were divided into teams and spent one month of class time brainstorming product ideas and dividing work among team members. After every class, a student was required to submit a one-page journal entry about what was accomplished during the team meeting, what issues came up, and anything else that was noteworthy about the team meeting. Students were graded on the quality of their writing as well as on their content. Before the contest entries were due, which was one month after the semester began, students were required to submit their proposals to the instructor, who would critique them, and to give oral presentations to the class. The students then would submit their re-written entries to the contest.

Students were very engaged in this assignment, which forced them to be active learners, and, in written evaluations, were very positive about this activity. This past year one of our teams placed as a finalist for a design of a watch that monitors vital signs, winning $1000 and the opportunity to meet with venture capitalists to discuss bringing their product to market beating out more than 200 other entries.

This class gave students the opportunity to develop other important CDIO skills. Other assignments include the design of an original experiment, and summarizing talks given by visits from a Suffolk alumnus of the department who works at Canon Design Inc and a group leader from a local defense laboratory. They also explored the ethical consequences of engineering decisions in an assignment on the Space Shuttle Challenger disaster.

## KEYWORDS

Written communication, oral communication, design, competition, creativity

## INTRODUCTION

The importance of technical writing in an engineer's career is hard to overstate; engineers spend a significant proportion of their time writing reports, memos, proposals, and giving presentations, and good communication skills are part of the CDIO and ABET outcomes. Therefore it is appropriate for engineering programs to include a course on technical writing.

Numerous textbooks exist on technical writing and some do an excellent job of outlining the important features of good technical writing such as writing clearly, accurately, forthrightly, concisely; knowing who the audience is and why they are reading the document; how to best transition between ideas. (I use *The Craft of Scientific Writing;* Alley,Michael 3rd ed., 1998) They discuss the features of writing such technical documents as memos, proposals, manuals, and resumes and give examples of good technical writing and bad technical writing. But what they generally do not do, unlike other technical textbooks, is give assignments. And therefore, the instructor is left to develop on his own, what assignments to give his students.

## THE ASSIGNMENTS

### Plagiarism is a problem

In my experience as a teacher of a technical writing class, I have found that if an assignment can be plagiarized, certain students will plagiarize, and therefore, writing instructors must do their utmost to develop assignments that cannot be copied from other sources. Although this task may prove daunting to English professors who assign papers on classics or history professors who ask students to research well known historical events, the technical writing instructor can have students write about original technical work that the student works on in class. Class time in a technical writing class needn't be spent on having the instructor lecture about the features of good technical writing since, unlike certain technical concepts, writing concepts are not difficult to understand. They are, however, difficult to implement, and the only way for students to learn these concepts is for students to spend a lot of time writing and re-writing.

### Class time can be used in creative ways to help students develop engineering skills

Class time in a technical writing class can be used for not only providing students with material to write about but also to help students become better engineers and to develop skills that are part of the CDIO initiative. This paper mainly describes how a design contest is incorporated into my technical writing class. But the assignments also include the design and presentation of an original experiment as well as summarizing talks by an alumnus who works at an architectural design firm and an Industrial Advisory Board (IAB) member who is a group leader in a defense research laboratory. They come to answer students questions about industry; to discuss how they use writing in their jobs; and to discuss how to successfully communicate in an interview and on a resume Another assignment involves students understanding the ethical dilemmas faced by managers and engineers involve in designing the Space Shuttle Challenger. All these assignments involve students learning and gaining experience in other engineering qualities besides good communication skills valued by CDIO such as technical entrepreneurship, design and experimentation skills, connecting with industry, and understanding an engineer's ethical responsibility.

## STUDENTS PARTICIPATE IN "NEW PRODUCT INNOVATION COMPETITION"

Suffolk University's Business School holds a contest each fall called "The New Product Innovation Competition", which requires students to develop a proposal for a product to bring to market. The proposals are due in early October and the award ceremony, where students

find out who won, is held in mid-November.  Three cash prizes worth $3500, $1000, and $500 are awarded and winners meet with business representatives and venture capitalists from such companies as Bose, Solutions F5, and M/C Venture Partners.  Since the dates of the contest are set, the design contest is the first major assignment of the semester   Ideally, it would be better if the contest assignment were at the end of the semester, after students had already had experience with other technical writing assignments, but the benefits of participating in a contest with judges, monetary prizes, and the chance to meet representatives from industry, I feel outweigh this drawback.

### How did it work?

The design contest assignment, in its current form, was introduced in Fall 2008. To motivate the students, and to convince them that they can develop a winning product, the organizer of the contest Dr. Sushil Bhatia of Suffolk University's Business School spoke to the students at the class' second meeting, held in the first week of September, and answered their questions.  I then divided the students into teams of four and five (there were nine students in the class).  The team had to decide on a team leader who is responsible for the overall quality of the project; each member of team needed to take responsibility for some part of the design, and to let me know what he/she is responsible for. Each team member received two grades: an individual grade and a team grade.  The entries for the contest were due at the beginning of October, so the students had four weeks to work on this assignment.

After every class, each student had to submit a journal entry on the team meeting of that day. The students were given the following assignment about their journal entries:

- *Your journal entries for your design product should be about one page long (12 pt font; double spacing).*
- *In them you should describe what you accomplished during your team meetings, and what future work you plan.*
- *Concerns or problems should be discussed too.*
- *The journal entries must be written with good English, in a clear and concise manner.*
- *You should write a separate journal entry, for each team meeting (2 per week).*
- *Sketches can be added on too.*
- *Each individual must write his own journal entry.*

A week before their proposals were due, students were required to submit their proposals to me and to present their proposals to the class (students are given a rubric which was taken from Northwest Regional Educational Laboratory held in1998. on which the grading of the oral presentations is based).  I graded and critiqued the proposals overnight (students are also given a rubric for the grading of their writing assignments which was developed by the College of Art's and Science's Dean's office), allowing students to rework their proposal before they submitted it to the contest.  In the fall 2008, my class submitted two design proposals; Appendix A shows the entry for a health monitoring device which won second prize. The other design was a design of an alarm system which used a piezoelectric sensor. The products were judged on their innovativeness, clarity of presentation, value proposition, and feasibility as well as other criteria.  Appendix B shows the judging evaluation form.

**MY IMPRESSIONS**

From the outset, students were engaged by this contest. In previous years, before this assignment was introduced, I lectured to the class about technical writing, and used the segments of the series *The Mechanical Universe and Beyond,* as well as other videos on technical topics as material for which the students could summarize. Students are certainly more active than when listening to my lectures, and they sometimes would use uncited materials in their summaries. Their journal entries are, by their nature, original and clearly demonstrate their writing deficits. One item that I did not put in to their journal assignments, which I should have, is for students to list who is doing what tasks on their teams. (I therefore asked that they put this information in their journals after their second journal entry).

The journal entries helped to clarify their thinking and understanding of their proposal, and I believe that gave the winning team an advantage over the other entries. There were over 200 of them, and three winners. Many of the entrants spent several months researching and developing their product design, so I was quite please that my students came up with a winning design in just one month). The alarm system team, I felt, did just as good a job in explaining their ideas, and I am not sure why the health monitoring device won over the alarm system. It could be because one of the judges was from the health care industry.

Although it was clear from their journal entries that not every team member contributed equally, it was clear that every team member contributed, and the teams worked well. Most of the students already knew each other (we are a small department) and they did a good job picking who the leader should be, and working with him.

**STUDENT FEEDBACK**

Students were asked, after they submitted their proposals but before the results of the contest were known, to give feedback anonymously on the design contest experience. I wanted the experience to be fresh in their minds, and did not want whether they won or not to influence their critiques. Most of the comments were positive and the experience was described as:

- Fun
- Exciting
- Creative
- Real-life
- Great for gaining experience in team-work
- Good for allowing journal entries to keep track  of progress
- An opportunity for engineering students to meet business students
- Good research experience

The negative comments included:

- Not enough time
- Difficult to meet with team mates outside of class
- Individual projects would be better
- Instructor should give more aid on the design

Appendix C contains the student comments.

### Addressing student feedback

I also felt that the students could have used more time on the contest; students basically have three weeks to develop their concept and one week to fine tune the proposal. However, as I stated earlier, I have no control over the time frame; that is decided by the business school. One goal of this assignment is to teach teamwork skills, so individual projects will not be assigned. Since product design is not my area of expertise, I don't think that I can give more support for the project than I already do, which is feedback on their journal entries such as asking students to elaborate on certain points, to explain their ideas more clearly, and to point out other considerations about their concept. Needless to say, their writing is critiqued and corrected as well In the future, I will have them go to the senior project instructor of our department, as well as other members of my department, so the students can get more help with their design. It may also be helpful to have an outside expert such as another professor, an alumnus or a member of our IAB, critique their ideas.

## OTHER ASSIGNMENTS

In addition to the product design contest, students were given other assignments that not only helped them improve their writing skills, but helped them improve their engineering skills as well. These assignments include: the design of an original experiment for which the students present a written and oral report; a paper on the ethical dilemmas faced by the engineers of the Space Shuttle Challenger; summarizing a talk given by an alumni who works in the electrical requirements of new office buildings and an engineering manager in a research in defence laboratory; an instruction manual; an oral presentation on a current topic in science and technology; resumes; and weekly reading assignments from the text. The following describes some of the features and pitfalls of these assignments.

### The design of an original experiment

I have found that the design of an original experiment works best when done in class, where students can use me as well as other students as sounding boards for their ideas. I suggest to them that they take an experiment that they have worked on in a lab or perhaps as a research project and modify it or study another quantity that they had not looked at, and test a hypothesis about what they expect their results to be. Students have three weeks to work on this assignment. Students can often feel overwhelmed by this task, and the more feedback they get from the instructor early on, the better is the student's work. If the experiment cannot be demonstrated to the class, the student needs to provide proof such as pictures or a video, that the student actually performed the experiment.

### Space Shuttle Challenger assignment

Students are shown a video featuring Roger Boisjoly, the engineer who tried to stop the Challenger launch and then suffered as a result of being a whistle blower, and are then asked to write a two-page paper on the ethical choices that the managers and engineers faced as well as how they think they would have acted had they been in the same situation. The main drawback of this assignment is that students may over rely on what's already been

written about the shuttle disaster and not do enough original work, but students usually do a fine job on it.

### *Alumni or representative from industry talk*

Students particularly appreciate hearing from an alumnus of our department or some other person from industry. They often have many questions and get good advice on preparing for interviews and on what to expect from the working world. They are asked to write a one page summary of the talks, which cannot be plagiarized.

### *Instruction manual assignment*

This manual assignment is the easiest one to plagiarize and no matter how many warnings I give about not looking at any other manuals to write their assignments, there usually are one or two students who plagiarize anyway. Those students receive a zero on the assignment and are made to redo them. I'm not sure what else to do about this issue except to be very vigilant about detecting it.

### *The other assignments*

The oral presentation on a current topic in science and technology usually does not pose any significant problems in its execution except to make sure students cite all their sources. Students are eager to have their resumes screened by someone from industry, and to ensure that the weekly reading assignments from the text are done, students are required to answer questions about them

### CONCLUSION

A technical writing class is a perfect vehicle for incorporating creative engineering endeavours such as participating in a design contest. Last fall teams of students spent four weeks working on a product design proposal for our business school's design contest competition. Generally students' experiences were positive and one team won second prize in the contest. Students were asked to write journal entries about each meeting, to submit for a grade their design product proposal, and to present to the class their design concept. The experience may be improved by asking outside sources to help them with their ideas and to review the students' proposals.

# SUFFOLK
## U N I V E R S I T Y
### SAWYER BUSINESS SCHOOL

**New Product Innovation Competition Submission Form 2008**
**For questions, please contact: Sushil Bhatia : sbhatia@suffolk.edu**

**Product Name:** _ Kronos Healthlink

**Group: Ivan Echeverria(leader), Pelerge Charles, Raul Artigas, Fabrice Kabore**

**Innovative New Product Concept**

**Product Name and Product Description:**
**Product Name:** Kronos Healthlink

**Briefly describe (25 words or less) what the product is:**
Revolutionary Health Monitoring Device that performs basic health information gathering for immediate analysis by the user's diagnostician.

**Product Origin:**
**How did you come up with this idea? Briefly describe.**
During my workout I experienced high levels of heart rate. When I informed my doctor he was unable to tell me the reason why my heart rate was too high. Likewise I was unable to recreate the exact conditions that placed my health in danger.
This device is capable of providing all the necessary information for any diagnostician to determine whether a patient's health was at danger due to a disease, environmental effects or to his own self-harm.

**Patents:**
Would you like to know more about patent and other methods of protecting your new product idea?
Yes

Value Proposition:
**Product Sale Price:** $300 - $450
**Describe your product's primary function as clearly as possible.**
**What does it do? How does it do it?**

The Kronos Healthlink is capable of:
- Monitoring blood pressure
- Monitoring heart rate
- Monitoring body temperature
- Monitoring environmental temperature
- Determining the user's current state of activity: either exercising, walking, jogging, or jumping
- Transferring securely the user's information to his doctor's server or a hospital server.
- Intercommunicating with the user's cell phone.

To achieve these functions the watch will have an advanced array of sensors and a user-friendly GUI (Graphic User Interface) with touch screen calibrated OS. This will give the user full access to the information being recorded.

To monitor heart rate we will make use of common standards by using a sensor that can sense slight changes of pressure throughout the median antibrachial vein. Furthermore the blood pressure can be determined in a similar way via the use of an inflating coating located at the inner belt that holds the watch to the wrist.

Temperature can be determined using thermistors (Resistor that varies with temperature); one located under the watch itself and the second one located at the top of the watch.

Bluetooth and Wi-Fi technology will allow the device to communicate with the hospital server, and all information will be sent with robust data encryption.

Furthermore, with the use of an accelerometer, and proper configuration, the watch will determine via the vigorous arm movement, whether the user is exercising or simply walking.

The accelerometer will also play a big part in the power management system as it will turn the touch screen "on", only when the user holds the watch horizontally to ground, thus saving power as much as it can via this sensing capability.

Moreover the watch will be powered by a rechargeable battery and will be able to charge using a dock set and "on-the-go" (I'm not sure what "on-the-go" refers to) via its solar panel coating.

**Signal Processing and Information management.**

The sensors register the different types of signals collected from the body and the environment. Then all the collected signals are passed through band pass filters. These filters reduce the "signal- to- noise" ratio and then send the analog information to a digital converter. Once the information is digitized a programmable microcontroller will further process the information and will display this information at the touch screen. The programmable microcontroller will also send the information to the WiFi chip for immediate data transmission.
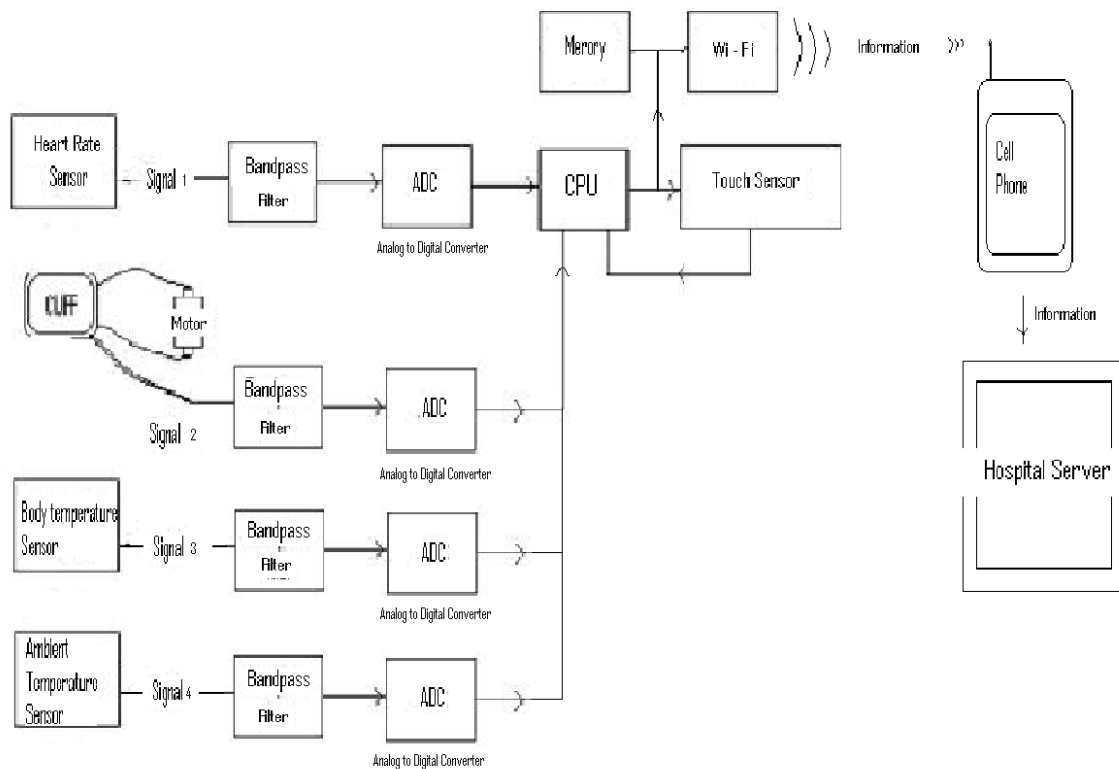
## Competitive Advantage

**List your product's competitors by manufacturer, brand name and model number; describe how your product improves upon competitive products or technologies and describe the uniqueness of your product over the competition's product. Also describe here if your product has "green" features and benefits.**

| Product | Features | Disadvantage | Cost |
|---------|----------|--------------|------|
| | | | |
| *The Exmocare BT2* | Measure heart rate, blood pressure, skin temperature and skin conductance, Bluetooth | Only available for clinical researchers, academics and small home health care provider. Battery need to be recharge every 6 hours | $ 2500 |

| | | | |
|---|---|---|---|
| *Suunto X6HR Heart Rate Monitor Watch* | Stopwatch Barometer Chronograph Thermometer Heart Rate Water proof | No blood pressure monitoring feature. Require battery maintenance every year | $ 398.85 |
| *Health Mark Body Tone Heart Rate Monitor Watch* | Heart rate monitor watch HR transmitter continuous HR display Cardio Building program. | No blood pressure monitoring feature. | $ 89.00 |
| *MW705 Heart Rate Monitor Watch* | Bluetooth transmission GPS signal, Water proof, reads NMEA data from GPS | No blood pressure monitor, short battery life | $ 200 |

The main functions of these products listed above are mostly monitoring a person heart rate or blood pressure but none of them come close to the Kronos Healthlink <-It's not clear to me how the Kronos is superior. There exists two actual products that perform the same functions as the Kronos Healthlink: The Exmocare BT2 which is the second generation of the BT1 and is mostly made for research companies and businesses. The BT2 is extremely expensive and contains half of the features of our product. The MW705 is a multifunctional sport watch but does not come with blood pressure monitoring functions. The MW705 is too vague and mostly made for athletes. The Kronos Healthlink is highly sophisticated, user friendly and costs about $ 300. With features such as Wi-Fi, and Bluetooth, our product is capable of streaming real time data to any physician's database. The Kronos Healthlink gives the user the ability for his physician or responsible caretaker to monitor his physiological data from virtually anywhere in the world.

**Feasibility**
**Briefly describe "what will it take to launch the product".**
**Cover the risks and rewards of implementation and execution. (Production, marketing, sales etc.)**
This revolutionary health monitoring system, uses the most advanced combination of sensors and communications technology on the market. It further introduces a novel power management system which uses an accelerometer as the central power management of the OLED touch screen, and it centralizes all its information with a robust encryption to be sent via WiFi or Bluetooth DUN (Dial-up Networking).

Most of these features can be found on top-of-the-line mobile phones, so we will not require new production practices and therefore production costs would be similar to that of mobile phones.

Keeping in mind that this device is aimed at health conscious people and disease-afflicted people, the price can be subsidized by most health insurance companies, thus, bringing the price to $100 or less. (Do you really know if health care companies will help pay for it?)

In the long run we could have a very successful product launch if we consider having medical insurance companies involved with it's marketing.

## Summary:

**State in layman's terms why you feel your product will be a success in the market...**

Our product is an all-in-one portable device which gathers and monitors real-time information about basic human vital signs. Having the shape of a watch, it is discreet and can be worn without being bulky or cumbersome. It also has the advantage of transmitting instantaneously precise information to a physician or any health service provider. Being equipped with WiFi and Bluetooth technology, it can communicate the data wirelessly from any place with wireless internet access coverage or using cell phone and at any time.

**Why is it important to have this product?**

Having this product will reduce the number of medical visits for a patient who needs regular monitoring of heart and vascular functions and will improve the responsiveness of emergency services in case of heart failure or cardiac strokes.

**What benefits will it provide?**

The product will help reduce mortality rates due to heart failure and vascular accidents and improve the lives of patients who need permanent medical assistance.

**APPENDIX B**

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**Suffolk University**
**Sawyer Business School, Boston, MA**
New Product Innovation Competition, 2008
Judging Scorecard

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**Judging Directions:**
Imagine that you are a consultant and your job is to evaluate new concept plans proposed by innovators individually or as teams. Please circle points **1. (Low) & 5.  (High)** that best describe how you feel about the submission.


**Date:**_____


**Name of Innovator**_____


**1.  Concept (Product Name):**_____


**A.  How bold and fresh is the concept (please circle)?**


**Ordinary**                              **1  2  3  4  5  Unique**
Seems old and familiar, not                            A new concept invoking a "wow"
creative, and may be repackaged                        response. May be a unique
as "new and improved".                                 combination of old ideas.


**B.  How persuasive and coherent is the concept (please circle)?**


**Crude**                                **1  2  3  4  5  Well-crafted**
Not persuasive. Seems sloppy or                        Clear, compelling, and
Incomplete and is not presented in an                  refined to its highest
understandable manner.                                 possible level.


**2.  Value Proposition**

 **How does the concept meet/create customer need (please circle)?**


**Low Value**                            **1  2  3  4  5  High Value**
Disconnected from customer reality                     Meets spoken or unspoken
and doesn't add much value.                            customer need, anchored in
                                                       experience.



**3.  Bottom Line Results**

 **How compelling are the concept's quantitative and qualitative benefits (please circle)?**

**Low Benefits**                         **1  2  3  4  5  High Benefits**
Insubstantial or inadequate                            Significant and credible
demonstration of quantitative and                      demonstration of quantitative and
qualitative results.                                   qualitative results.



**4.  Competitive advantage**

**How does the concept provide a unique and competitive advantage (please circle)?**

**No Advantage**                 **1  2  3  4  5**   **Tremendous Advantage**
Does not provide significant                            Competitive advantage is
competitive advantage for the                        significant and hard to mimic.
company.

**5. Feasibility**

**How easily can concept be implemented and are risks addressed (please circle)?**

**Low feasibility**                 **1  2  3  4  5**   **High feasibility**
Does not seem feasible. Poor risk                  Seems feasible and risks are
assessment.                                  properly addressed.

**6. Does this product have "green" features i. E. Is it environmentally friendly and safe (please circle)?**

     **Low**       **1**       **2**       **3**       **4**       **5**       **High**

**7. Special Bonus Points (Between 1 and 5 points)**

**Total points =_____**

**8. Your comments/suggestions to the innovator**

**Name or the Innovator**_____
 **Name of the Product**_____

**Judge Information:**                             **Date completed:_____**

Name of Judge: _____

Company: _____

Address: _____

City: _____      State: _____      Zip Code: _____

Tel: _____:       Email: _____

Signature: _____

**APPENDIX C**

1. "The design contest was an amazing way to bring together the class to work towards a project that could be very helpful for future generations. This competition also helped the engineering students match up to the business schools students. This competition was fun and exciting as it made us all think of various new technology that some had only thought of as a dream that would someday take shape to reality. The team work was awesome and helped us know each others potentials and specialties. The journals helped boost our grades and were a great way to keep track of ever step of progress towards our design."

2. "The design contest was a great real life experience. We teamed up to go through a design process of a new product. The meeting reports were a good decision that kept track of what we were doing. Required a lot of research, which was great to get us familiar with new technology. Overall great task."

3. "The design contest was a learning experience for me because I have never participated in such context. The good thing about it is that the context taught me how to be creative. Working on a team gave me the importance of being a team player. Two things I would change is the way they organized the proposal form, I think the contestant should have the freedom of writing it on our own format, and the instructor could also have the class compete among themselves."

4. "The design contest brought team-work experience to the whole team. It has taught us what it's like to be in the real world where we have to come up with a design, prototype, and revision. Not everything were given to us; we had to research on our own and bring it up during our group meeting. Working in groups has it advantages where we all can come up with different solutions and pick the best one out of all. A disadvantage is we have all have different schedule therefore it is hard for us to meet outside of class time. I find it hard to contact other people because some of the member never reply to email or answer phone calls. I would recommend the instructor to have students work individually in the future. Student can come up with their own projects but they can seek each other for help on revision or new idea. This is fair for the rest of the students because each student can come up with their original idea and do their own work. Another recommendation is that the instructor should aid us more on the design and give us feedback."

5. "I think that we did not have enough time to provide a well studied design product. Indeed there was a lot of theoretical assumption as part of the feasibility of the whole project. T he good point was the chance to think about innovation and the experience of a team work. I think our team worked well together and this is an experience worth doing."

6. "Team work is very hard to accomplish unless a good leader is in the group. Sometimes the group leader does not have the energy and time to lead. Furthermore, a randomly picked group by the instructor adds to the problem of leadership. Thus, in order to save time and headache is better to have individual project.
Another issue is time; I don't think that 3 weeks is enough time to summit a good proposal. Designing a good picture or diagram of the product takes time. The goal is to win the competition; hence a well elaborated proposal can accomplish this goal, and a good proposal takes time to put together."

7. "The design contest was overall a good experience. It provided a good way to practice journal entries. However I wish that there was a little more structure, maybe to share the design with the class before writing the proposal. Our team worked together great, no problems at all."

***Biographical Information***

Lisa Shatz is an assistant professor and chairman of the Electrical and Computer Engineering Department of Suffolk University in Boston, MA. Her research interests include understanding the relationship of shape and function of sensor hairs in such biological systems as vibrissae and inner ear hair cells.

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