Teaching at USMA

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We Want YOU. . .

…to contribute your good ideas for enhancing cadet education at USMA. Last semester, we published a booklet of faculty accomplishments,. *Excellence in Teaching at USMA*, and we'd like to publish another edition this semester.

Previous editions focused on entire courses, as in the article on page 3 of this newsletter. However, often faculty members benefit more from those great ideas that involve a simple technique in class. One page 2, you'll see two good examples of this type of idea that's worth sharing. Some faculty members have been using Blackboard creatively, and we're also interested in sharing those ideas with the entire faculty.

Whether you have a course-specific technique to share or simply something you've found useful in your classroom, we hope you'll consider submitting it to us for publication.

Send us your ideas, accomplishments, techniques to share with your colleagues on the USMA faculty—any length is OK. We'd like to hear from you NLT 2 February.

If you have any questions about this, please don't hesitate to contact Anita Gandolfo at any time.

Interested in TALENT?

Throughout the country, there is tremendous interest in the use of technology to promote student learning. But one of the major issues that is not addressed is the assessment of all these fine ideas to see if they actually impact learning in any significant way. In fact, there may be negative effects that are not readily noticed due to the lack of systematic assessment of the results.

A particular problem at USMA is that many fine ideas are developed by rotating faculty members, and their contribution is often lost when they leave. The CTE has a "program" that we call TALENT (Teaching And Learning Effectively using New Technologies), and we'd like TALENT to not only support faculty members in their work with teaching and technology but promote the dissemination of these good ideas.

If you are interested in either developing a technology application or assessing one you're currently using, the CTE can help. We can not only help you design your project, but we can provide financial assistance as well thanks to the generous gift of Mr. Rick Adam, USMA Class of '68. For projects selected, we will provide $500 in support, as well as funding for at least one conference presentation. (There could be additional support if needed, for a particular project, depending on resources available at the time.)

If you'd like to partner with us in TALENT, please contact the CTE at any time!

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Teaching Tips

Here are a couple of tips from former USMA faculty members.

Leader, Critic, Spy by MAJ John Hartke

(reprinted from CTE newsletter several years ago)

Many times in math, science, and engineering courses we send cadets to the boards to work problems. As instructors we do this to assess the cadets' ability to apply the principles and concepts we are covering in that lesson and give them immediate feedback. Many times as we do board work, the information never makes it to the cadets' notes and inevitably a couple of cadets get left behind. Teaching physics I have discovered a method to keep the class together, maximize peer instruction, and get the problems into the notes. The method I use is called leader, critic, spy.

To start, I send the cadets to the boards in groups of three. Each cadet is assigned a role that rotates from problem to problem or class to class. The three roles are the leader, the critic, and the spy. (I allow a group of four where the fourth cadet is another critic, but no groups of two)

The Leader – The leader is the cadet who commands the chalk and puts the work on the board. In the group, he or she is the only one who is allowed to touch the chalk, and is responsible for leading the group through the solution.

The Critic – The critic is responsible for insuring that only correct work ends up on the board. He or she critiques the leader and helps through the solution. The critic is also responsible for briefing the board to the class.

The Spy – The spy is responsible for writing the correct solution onto paper and passing it to the group. If the group gets stuck, the "spy" is allowed to go anywhere in the room to get the answer.

This technique increases the involvement of all cadets and allows them to teach each other. The leader has to know how to do the problem, the critic has to know what's going on in order to brief, and the spy has to know what information is needed to help solve the problem.

If the entire class seems to be stuck on a particular part, I call for an intel update. An intel update is where I call all the spies to the center of the room, and we discuss where everyone is stuck. I coach them to the next step, and the spies go back and push their groups in the right direction.

We also have rally points. A rally point is a point in the problem solution when I stop the class and have one of the groups brief their progress. I use this when one group is starting to break away from the rest of the class in terms of finishing the problem. This allows the other groups to catch-up and allows me a chance to emphasize important intermediate points. After the entire problem is briefed, I allow time for the critic and the leader to get the basic information. They then get the detailed information from the spy.

The challenge for this technique is keeping the cadets in their roles Oftentimes the critic or the spy knows how to do the problem and wants to take charge and do the writing. The other challenge is that this can take more time than individual boards.

In all the cadets seem to enjoy playing the roles. They do a good of passing information between groups and among the cadets in the group. I get a good assessment of where the whole class is and not just a few.

Using the News

(contributed several years ago by MAJ Alain Balmanno, formerly of D/Law and now retired)

To get cadets engaged, I start every class of LW403 core (core course in law) with a question about what's in the news. Most days the cadets come ready with news stories related to law. It starts the discussion, serves to get them interested in the topic outside the academic grind, and shows them how the class material is relevant to their future and to what is going on in the world. In case they don't have news stories, I always have one or two ready to use.

Your Contribution?

As explained on page 1, it can be as detailed as that of MAJ Van Poppel and MAJ McKay (p. 3) or as brief as that of MAJ Balmanno (above). By sharing ideas that have worked, we may inspire a colleague to either adopt that idea or adapt it in another way. As this semester ends, please think about something you'd like to share and sent it to Anita Gandolfo at the CTE NLT 2 February.

2. Goal is to get

2. Goal is to increase competence

3. Develops negative emotions toward task

Believes lack of ability responsible for failure 1.

Believes lack of effort responsible for failure

THE WATER TURBINE COMPETITION

A Project that Injects Fun into a Challenging Course

MAJ Bret P. Van Poppel and MAJ Michael D. McKay
Department of Civil and Mechanical Engineering

Introduction

For the past five semesters, the Water Turbine Competition has significantly added excitement and motivation to the historically dreaded Fluid Mechanics course offered in the Department of Civil and Mechanical Engineering. Adopted in 2001 as the course design project for ME362, Fluid Mechanics, the Water Turbine Competition is an adaptation of the national Hydropower Contest. Teams of two or three students build a water turbine that will lift a weight eight feet using only the potential energy stored in a 30 liter tank of water that is suspended 13 feet above ground level. Students compete in one of two classes: the Power Class requires that a 1.25-pound weight be lifted as quickly as possible using one of five supplied turbine wheels; the Torque Class requires as much weight as possible to be lifted and allows students to fabricate their own turbine wheel. Over the past three academic years, the water turbine project has proven to be an exciting project for students and a very beneficial educational tool.

Project Development

While the Water Turbine Competition has evolved into a very effective course event, its development has come as a result of many semesters of improvement. One of the challenges has been integrating the project into the course so that students had enough knowledge to perform the required analysis and still have enough time to build and test their devices. As a result of student feedback and faculty assessment, several analysis-based in-progress reviews (IPRs) and a formal safety class have been programmed into the syllabus. Compared to initial offerings, the competition date has been moved earlier in the semester to allow more time for students to complete a high-quality technical report. Instructors now observe better projects, higher-quality reports, and improved student learning as results of better course - project integration.

Instructors have improved the competition significantly over the past two years. Initially only a course event, the Water Turbine Competition is now advertised throughout our Department and regularly draws many faculty members and students—including students not enrolled in the course. An updated Leader Board provides up-to-the-minute standings as well as current competition "bests." At the end of each group's competition run, students are photographed with their devices and only the very best are displayed proudly in the Hall of Fame.

Student and Instructor Feedback

In response to a voluntary web-based survey, a surprisingly large percentage of the students—74%—either *strongly agreed* or *agreed* that the turbine design competition inspired student curiosity about fluid mechanics phenomena. Although it is somewhat unclear why the project piques so many students' curiosity, a possible explanation lies in the fact that the design is a competition. Students are told that top groups will receive recognition and a Hall of Fame and Wall of Shame are maintained to showcase outstanding entries. This undoubtedly motivates some students and has them continually thinking about how they

Many students also commented favorably about the hands-on nature of the project. It is likely that students place a high premium on the kinesthetic attributes of the project because most have no physical reference for the relevant flow parameters as a result of only in-class theory and homework problems. One student wrote:

> *This project gave me a frame of reference to use when looking at the problems we faced. Otherwise I don't really have a way to connect the number we use to a real world problem.*

The project illustrates whether a velocity of 25 feet per second is relatively fast or slow, whether 13 feet of elevation head is a little or a lot. The project reinforces concepts introduced in other courses, such as torque and power. Additionally, the Water Turbine Competition develops problem solving skills and creativity, as one student explained:

> *This project highlighted many of the difficulties one may encounter when designing and building even simple engineering projects. I feel better prepared to anticipate problems and think of creative ways to overcome them when it comes time to plan and build more complex designs.*

Instructors have maintained records of students' average turbine output power—the results of the first four semesters of the Water Turbine Competition are displayed in the figure below. Clearly, student performance has steadily improved. Instructors attribute this improvement to the following factors:

- Improved course-project integration.

- More effective use of the engineering design process. The design process is a proven and structured methodology that works when appropriately applied.

- An exciting, well-advertised competition. Harnessing students' natural competitiveness has inspired many to excel beyond expectations.

Some contest action

(Continued on page 4)

THE WATER TURBINE COMPETITION

(Continued from page 3)

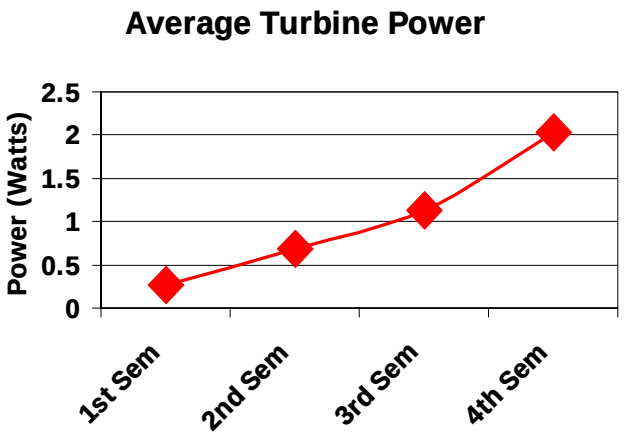

Figure 3: Average Turbine Output Power

Conclusions

Hands-on design projects, such as the USMA Water Turbine Competition, are excellent educational tools. The turbine project provides a direct physical application of the conservation laws, offering students a quantitative reference for flow parameters rather than just numbers. Because of its kinesthetic nature, the project inspires more cadet curiosity about fluid mechanics. As a group exercise, it fosters teamwork and collaborative learning among students. Most importantly, however, the Water Turbine Competition has injected some excitement and motivation into a conceptually challenging (and historically dreaded) course. Survey responses consistently reveal that students believe the project is more fun, interesting, and developmental than a "paper design"—even though it requires more work.

[1]Reed, S. and Van Poppel, B., "Achieving Course Objectives: The Benefits Of A Hands-On Design Project ", 2003 American Society For Engineering Education Annual Conference & Exposition

[2] http://users.rcn.com/hands-on/hydro/contest.html

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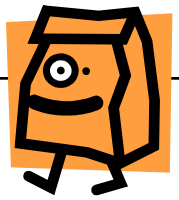
Brown Bag Ideas?



It's time to begin planning for next semester, so if you have any ideas for topics you'd like to have discussed at our Brown Bag sessions, please don't hesitate to contact Anita Gandolfo at any time. Suggesting a topic does not obligate you to attend the session:-)