AC 2001-910: SO YOU THINK YOU KNOW DYNAMICS?

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Extended Abstract

This interactive presentation will explore undergraduate dynamics. The objective of this presentation is to encourage you to take a fresh look at undergraduate dynamics and mechanics. Hearing this presentation just might change your paradigm! Keep reading this abstract until you are convinced you should attend the session. The less you know about the session, the more fun it will be. However if you need to know more, read on!

The anticipated topics include: fundamentals; precision; appropriate EC2000 outcomes; communication; instructional methodologies; collaborative learning; and teamwork. The anticipated outcome of the presentation is an audience encouraged to take a fresh look at undergraduate engineering courses in general, and dynamics in particular. This presentation is not recommended for those unwilling to get into a vigorous discussion, perhaps even an argument!

I have attended the annual conference for many years. Each year I find the conference stimulating, exciting, and useful. However one thing gets my goat every year. In presentation after presentation we hear how lecturing is the least effective instructional mode, and how important it is to encourage collaborative learning and student involvement, and working at higher levels within Bloom's taxonomy. And what do we get in the conference itself? Lecture presentation after lecture presentation with perhaps a few minutes for questions at the end. If this is really the worst way to encourage learning, then why do we keep doing it at the conference? And if we are doing it at the conference, isn't it likely that our reliance on the lecture mode of instruction is heavier than it should be when we return to our home campuses? This led me to conclude that it is imperative to demonstrate that alternative approaches to instruction can work, even at the ASEE Annual Conference. I believe that a highly interactive, collaborative learning environment requiring audience participation and thought can work at our conference. I propose to demonstrate just how it can be made to work. By doing so I hope to stimulate thought on some important issues in engineering education and simultaneously emulate styles and methods that the audience can apply on their own campuses. Big talk, right, but can I back up these claims? Come to the presentation and find out! Don't read any more of this abstract unless you are still not convinced to come to the presentation.

I propose to begin the session with a brief description of an engineering situation involving dynamics (if I told you the situation now it would take all of the fun out of it when the session arrives). I will describe certain occurrences or experiences that are a part of that situation. Then I will ask the audience to break into small groups (2, 3, or 4) and develop as a group an explanation of the occurrences or experiences. Their explanation needs to be technically correct,

but must be exclusively verbal, no pictures, no equations. After a short period of time (remember this is a group of experts in the field of dynamics), I will reconvene the body, and in the military tradition, select volunteers for presentations of their explanations. Still not convinced? If not, then keep reading but realize the amount of fun you will have in the session is reduced the more you know about what will happen (surprise party phenomena).

Naturally at this point the results are somewhat unpredictable, but that is what makes the learning environment challenging, stimulating, and effective. As the "teacher", that means guide on the side, not sage on the stage; it will be my responsibility to make the most out of whatever happens.

One of the expected events is that one or more groups may use language that is not particularly precise or is not especially consistent with the underlying principles. This will create an opportunity to discuss engineering language: the importance of words, the need for precision, and the need to keep in mind fundamental principles, not only when doing the mathematics but also in verbal and written reports.

I also expect an opportunity to discuss what we are really trying to accomplish in our undergraduate courses. What is the importance of students being able to work a problem from the end of a chapter relative to their ability to explain and discuss how fundamental principles apply to an engineering situation? At what level in Bloom's taxonomy do we normally operate, what level was required in this exercise, and at what level should we be operating? How does this impact the course outcomes that we must establish for EC2000? If we rethink our desired outcomes, what of our assessment measures? How does all of this impact how we structure our courses?

Another area of discussion that should open up will be whether the instructional mode used could be effective in developing communication and teamwork skills without a significant sacrifice in engineering content. Talking about dynamics is a far different challenge from working a problem on a closed-book exam.

If time permits I will ask members of the audience their reactions to the opportunity to discuss their ideas with their group and the subsequent whole-class activity. Among the anticipated reactions are enjoyment or perhaps it was more challenging than they had expected. Or maybe something came up that some hadn't anticipated. This would enable me to focus the group on just how desirable these sensations are in a group of engineering students. Of how we are able to elicit these reactions and still be doing "hard" engineering. Or how the "soft" engineering emphasized in ABET 2000 can be at the heart of engineering science.

Another avenue of approach that may open would be a discussion of the strategies I used in preparing/planning the session. Why did I do things the way I did? What worked? What didn't? Advantages/disadvantages? What other things could have been done with more time? How does this mode of instruction impact on what the students need to be doing outside of class? What could be borrowed from this presentation and taken back by the audience to their home campuses? What are some other situations that would make for a good discussion? What related experiences and activities have members of the audience already been using in their classrooms?

Conclusions are always a challenge when you don't know where you will have been! Nonetheless, I anticipate trying to pull things together into a meaningful conclusion. I anticipate encouraging the audience to revisit their desired outcomes for undergraduate engineering courses - perhaps giving greater weight to the ability of the student to understand and explain engineering situations and problems. This would impact everything about the class; from instructional methodology, to homework assignments, to exams. Secondly, I anticipate encouraging the audience to evaluate the potential of considering alternative instructional methodologies. Students involved in talking, even arguing, about engineering applications are students learning! Hopefully you aren't reading this, but if you are, come to the presentation anyway! See you there!

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Nels Madsen is an Associate Professor of Mechanical Engineering and the Associate Dean for Assessment and Special Programs of the Auburn University Samuel Ginn College of Engineering. Dr. Madsen received a B.A. degree in Physics from the University of Iowa in 1974, and a Ph.D. in Mechanics and Hydraulics from the University of Iowa in 1978.