

# CHEMICAL ENGINEERING DEBATES

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Real engineering problems are rarely black and white. This is particularly true when problems are placed on the canvas of societal, economical, ethical, environmental, and political considerations. There are, however, few (if any) places in the standard undergraduate curriculum to discuss and debate complex interconnected issues, exploring the pros and cons of various positions. With that in mind, a little over four years ago, the Chemical Engineering Department at Northwestern University initiated a novel activity designed to achieve several differing goals. It is known as our annual "Chemical Engineering Debates," the fourth of which was recently held. We have been highly pleased with the results of this activity and would like to share our experiences with others in the community who may wish to consider similar programs within their own institutions.

## GENESIS OF THE DEBATES

The idea for the debate program grew out of concern for the following issues connected with our undergraduate program:

- An absence of significant discussion on chemical engineering issues in the context of societal, environmental, and political constraints.
- A lack of opportunities for informal faculty/graduate student/undergraduate interactions.
- A scarcity of intellectual discussion among students and faculty on issues outside of the classroom or curricular issues.
- The ever-increasing tendency for faculty and students to narrow their focus to issues of immediate professional and/or academic interest.

Another concern, perhaps less prominent at the time, was the need to take some steps to focus attention on awareness of broad societal issues and on the importance of life-long learning among our students, as mandated in the then up-

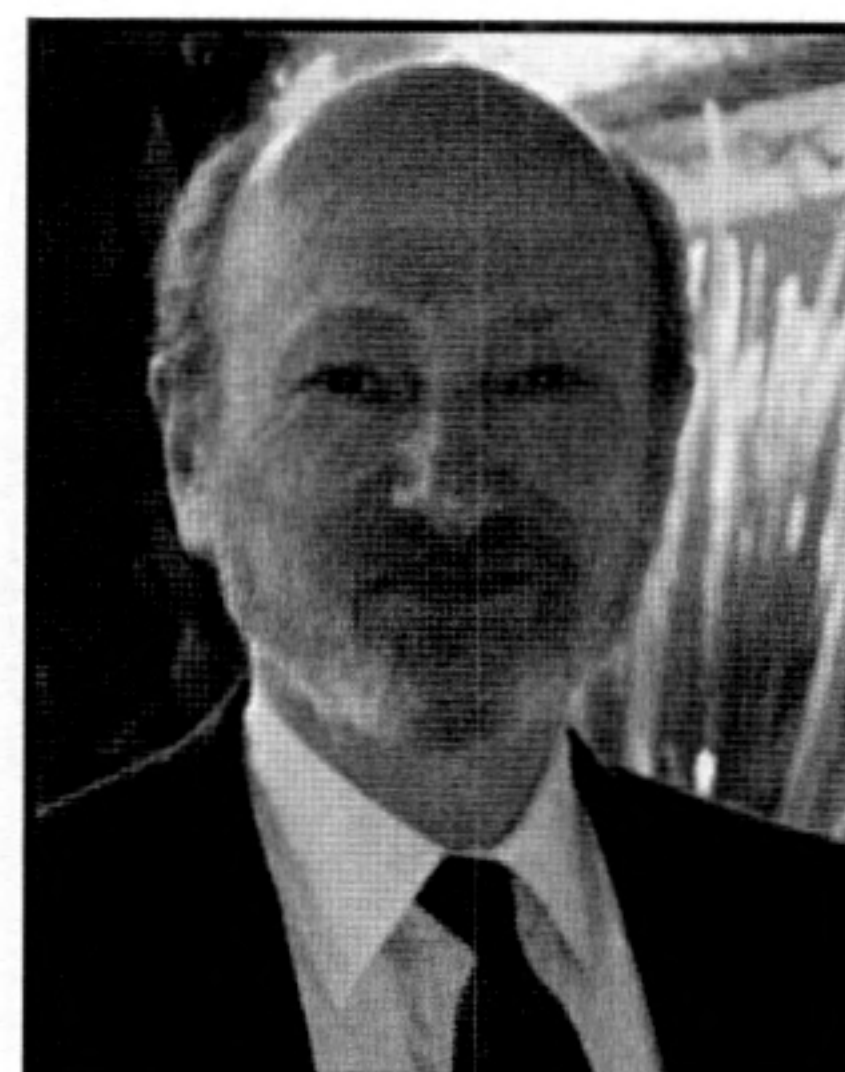
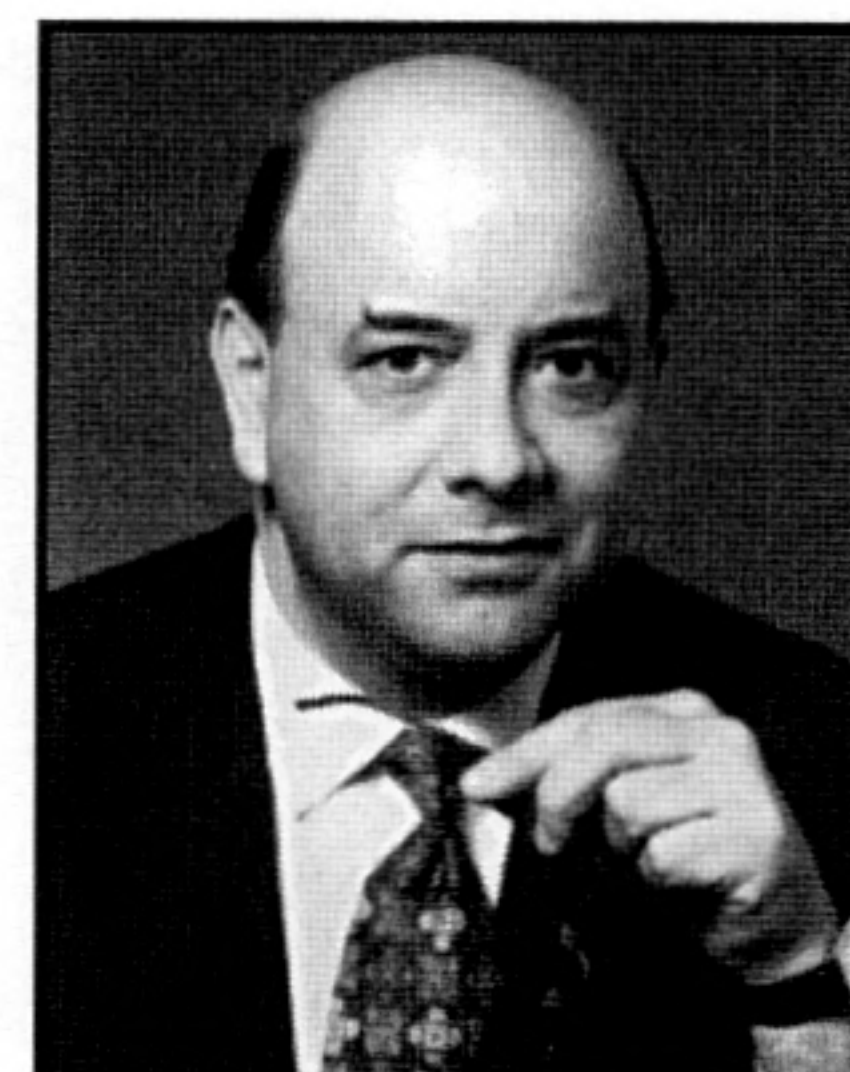
coming ABET EC 2000 expectations.

Consideration of these issues led to the formulation of plans to initiate a debate-type activity. This was fostered by a long-standing tradition of excellence in collegiate debate at Northwestern and the fact that one of the graduating seniors in the class of 1997 (Ian Smith) was a member of the much-heralded Northwestern debate team. Specific reasons for choosing a debate format included the opportunity to put together mixed teams of students and faculty and to focus on technically based issues of social significance. Our thoughts, borne out in subsequent events, were that students and faculty would be able to work together effectively outside the classroom and that this type of event would be of significant interest to other students as well.

## PAST DEBATES

Four successful Chemical Engineering Debates have been held. The general topics, specific questions posed, and the moderators are listed in Table 1.

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**TABLE 1**  
**Debates Held at Northwestern**  
**University**

**March 1997**

*Topic:*

Future Directions for the Petroleum Industry, Exemplified by Exxon

*Question:*

Should Exxon shift its long-term, strategic focus away from petroleum

*Moderator:*

Mr. Jay Hook, Retired Group President, Masco Corporation; Adjunct Professor at Northwestern University

**March 1998**

*Topic:*

Sustainable Development: Implications for the Chemical Industry

*Question:*

Is sustainable development a viable business strategy for Monsanto Chemical Company?

*Moderator:*

Dr. Warren Haug, Retired Vice President Research & Development, Procter and Gamble Company; Adjunct Professor at Northwestern University

**May 1999**

*Topic:*

Policing the Biotechnology Industry

*Question:*

Should knowledgeable scientists and engineers working in the field of biotechnology be responsible for regulating the industry or should a government body be charged with this responsibility?

*Moderator:*

Dr. Edward Hughes, Professor Kellogg Graduate School of Management, Health Services Management Program, Northwestern University

**May 2000**

*Topic:*

Global Warming and Greenhouse Gas Emissions

*Question:*

Should the United States seek legally binding limits on greenhouse gas emissions for all nations at this time in order to combat global warming?

*Moderator:*

Professor William White, Industrial Engineering and Management Sciences, Northwestern University; Retired CEO, Bell and Howell Company

**ORGANIZATION**

Let us now discuss the implementation issues, using the first debate as an example

**Organizers**

Strong initial faculty effort is essential. But for the activity to be successful in the long run, continual student leadership is necessary. A team of one undergraduate and one graduate student seems ideal, although we have had one instance of two undergraduates serving as organizers. The organizers lead the recruiting of debaters, frame the topic selection, and take care of publicizing the event, including preparing flyers with brief bios of the participants for distribution at the debate itself. Several discussions between the organizers and a faculty consultant are usually needed to converge on a suitable topic.

**General Structure**

In setting up the debate structure, we were concerned about the extra burdens that participation in the debate would impose on both faculty and student team members. While recognizing that few activities are successful without the significant effort of some key individuals, we did not want to place unrealistic and discouraging demands on participants who already had full schedules. Therefore, some preparatory work on topic selection and digestion of key background materials by the debate organizers was deemed necessary. We decided that all participants would be given basic background information two to three weeks in advance of the debate, but that the specific question to be debated and the assignment of "pro" and "con" positions would be deferred until the week before the scheduled debate. Thus, in the 1997 Exxon debates the positions debated were

***Affirmative:** Oil is here to stay; oil should remain the strategic focus of Exxon.*

***Negative:** Oil is on its way out; Exxon should shift its strategic attention away from oil.*

**Participants**

In order to involve as much of the department as possible, we decided that each of the two debating teams would be composed of six members: two undergraduates, two graduate students, and two faculty members. All of the participants were to be volunteers, solicited in each case by a member of the relevant group. The number is not rigid. More participants increase the chance of people to participate directly. Six persons per team is probably an upper bound and requires that everybody adhere to the allotted times. Incidentally, with the exception of our very first debate, none of the participants (students or faculty) had prior experience as debaters at the collegiate level. Nonetheless, this did not appear to diminish their enthusiasm or effectiveness.

**Moderator**

The choice of the moderator is critical. Ideally, the moderator should be knowledgeable in the topic, but nonpartisan, and should have name recognition to serve as a draw for the event. The choice of a moderator for the debate

## Graduate Education

provides an additional opportunity to broaden the scope of activity by involving an individual not associated in the normal life of the department. The university community offered many potential candidates. The role of the moderator is to introduce the participants, keep discussion within the allotted time, and to provide an overall summary of the discussion.

### Topic Selection

Choice of the appropriate topic is very important. An appropriate topic should be of obvious relevance to a technically educated audience, but of sufficient general interest so a number of differing views might be anticipated. The topic should also be reasonably accessible to those relatively uninformed about it, and there should be background and evidence readily available through common media outlets, such as magazines, journals, videotapes, and through the Internet. For example, in the 1997 Exxon oil debate, the position paper was a speech delivered by the Chairman and CEO of Exxon Corporation, Lee Raymond (B.S., ChE., University of Wisconsin 1960; PhD, ChE, University of Minnesota 1963) at the Economic Club of Detroit and published in *Vital*

*Speeches of the Day*.<sup>[1]</sup> (Incidentally, reference 1 is a good source of debate topics.)

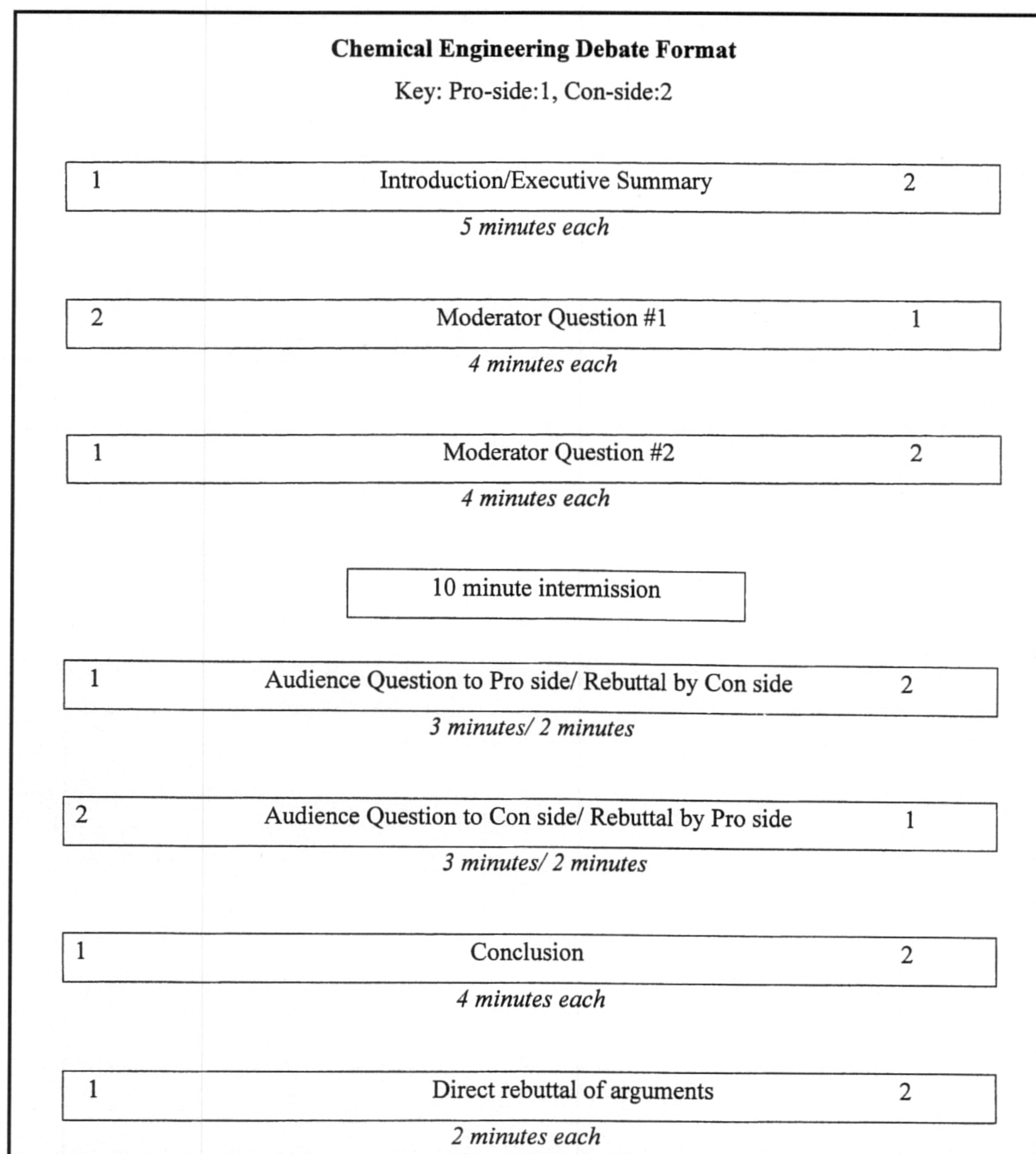
It is important to note that whatever the position assigned to debate (pro or con), the arguments should be grounded on realities. In the case of the Exxon debate, the opposing positions can be formulated as

*"If I were in Lee Raymond's shoes, I would take the same approach."*

*"If I were in Lee Raymond's shoes, I would take a different approach."*

Thus, if the position "...I would take a different approach" was assigned, one has to argue from the point of a CEO who is responsible to a Board of Directors, to shareholders, etc., backing the arguments with numbers and not on indefensible, however lofty and heartfelt, environmental concerns.

In the case of the 1998 Monsanto debate, the central documents were an article on sustainable development<sup>[2]</sup> and an interview with Monsanto's CEO, Robert Shapiro,<sup>[3]</sup> both published in *Harvard Business Review*. Other debates were grounded on more voluminous general literature. (See, for example references 4 and 5. Reference 5, in particu-



**Figure 1.**  
*Debate structure*

lar, suggests several topics for debate.)

### Structure of the Debate

We decided to incorporate both prepared and extemporaneous remarks in the debate program. Each side would have opportunities to state its position initially in prepared remarks, and then to respond to questions posed by both the moderator (presented to the teams in advance) and the audience (collected during the debate). A flow sheet of the typical debate structure is indicated in Figure 1.

### Physical Arrangements

In order to separate the debate from the usual departmental schedule of activities, we decided to schedule it in the early evening, beginning at 7:00 p.m. and preceded by an informal supper (an additional incentive for student attendees). Selection of a suitable room involved consideration of appropriate space for seating of teams, the moderator, and the audience; good sight lines and acoustics were also of major concern. The ideal arrangement consists of two long tables, each capable of seating the six members of the teams, with a lectern in the middle for the debaters to address the audience. Ideally, the tables should be slanted in such a way that they face each other and the audience, with a smaller mid table for the moderator. Inevitably, some compromises are necessary because of typically heavy demands on spaces large enough to seat up to one hundred people.

### **VARIATIONS**

Several variations on the above theme are possible.

#### Increasing the number of participants

Not all students have the inclination to share the spotlight and to actually be debaters. A possibility for increasing participation is to include "topic researchers." These people actively seek material and participate in the briefing and discussions, and they may take notes and prepare positions for the rebuttal sections of the debate, but they do not participate in the public aspects of the debate.

#### Increasing spontaneity

Prepared questions make the debate seem "rigid." Alternatively, the questions posed by the moderator may not be revealed to the teams in advance, thus forcing teams to "think on their feet."

#### Increasing audience awareness

The audience may not be aware of the major issues in the debate. Relevant background material might be posted on the web prior to the debate.

#### Engaging the community

Often the best ideas occur after the debate is held. Fol-

low-up of the debate issues in relevant courses can extend and increase the benefits of this activity.

### **OUR EXPERIENCES THUS FAR**

Each of the four debate topics has served to engender significant discussion among the students of the department. The debates have provided a forum for discussion of these timely topics and have been successful in bringing together the faculty and students of all levels. Inevitably, a debate creates an awareness in students for noticing and following a topic in the news (Exxon was the most profitable company in 1997; Monsanto's entry into the biotechnology market did not anticipate the European resistance to genetically modified (GM) crops, etc.).

A brief survey of attendees at the most recent debate indicated unanimous agreement that the debates should be continued at a frequency of about twice a year (currently, the plan is to stay with one debate a year). Respondents also indicated that the most attractive aspects of the debates were the interaction among students and faculty that they produced and the focus on broad, socially relevant problems that they provided.

In view of these responses, coupled with our own conviction that this program is indeed fulfilling our original expectations, we plan to continue with the Chemical Engineering Debates on an annual basis. We are particularly pleased that this activity, which started with major input and direction from faculty members, has now become institutionalized as a student-directed and organized event, with the leadership role undertaken by our AIChE Student Chapter in conjunction with the Graduate Student Forum, our departmental graduate student organization.

We are also particularly pleased to note that this activity has now been embraced by the larger Northwestern University community. A series of once-a-quarter University-wide debates has just been announced (and named "The Great Debates"). They will begin in the 2000-2001 academic year and will address important topics cutting across all university lines.

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