2001

Annual Report, 2001

University of Arkansas, Fayetteville. Dale Bumpers College of Agricultural, Food and Life Sciences. Dept. of Biological and Agricultural Engineering

I. SIGNIFICANT ACHIEVEMENTS AND CHANGES

Dr. Lalit R. Verma began as Department Head on July 31, 2000 after being at LSU for 21 years.

The undergraduate program was revised to a science-based Biological Engineering curriculum. This will be implemented in the Fall of 2001. This was a high priority with the Accreditation Board for Engineering and Technology (ABET) visit scheduled in Fall 2002. The proposal received University approval in Spring 2001. Biological Engineering is the branch of engineering that prepares students to apply engineering to solve problems in biological systems. Some examples of this are bioprocess (food, nutraceutical, pharmaceutical, bioconversion, bioreactors), bioenvironmental (bioremediation, water quality, natural resources and non-point source pollution), biomechanical (machine design, precision agriculture, mechanization), and biomedical engineering.

The revolution of biotechnology, genetic engineering, biomedical, and bioprocess engineering has just begun. Engineers trained to apply their expertise to various biological scenarios will have exciting job opportunities to choose from. Additionally, this engineering program will allow students to enter medical, dental, veterinary school or pursue graduate engineering programs in biomedical or biotechnology engineering.

We have defined the areas of concentration in Biological Engineering to be Food and Bioprocess Engineering, Bioenvironmental Engineering, Biomechanical Engineering, and Biomedical Engineering (including Pre-Med). These will also have a close match with research focus areas of our department.

A new brochure describing the new Biological Engineering program was developed and was mailed to all in-state and a few adjoining out-of-state High Schools in Spring 2001. An electronic module on Biological Engineering was also prepared and is available on CD or videotape. Several requests for this module have been received from counselors and prospective students.

The BAE Advisory Board was reactivated and the first meeting of this group was held on October 13, 2000.

The department hired three new faculty members. Dr. Jin-Woo Kim will be joining the department as assistant professor in July in the area of Biotechnology/Bioprocess Engineering, Dr. Sreekala Bajwa will begin in August in Biomechanical Engineering and Dr. Marty Matlock will join us in September in Bioenvironmental Engineering.

Spring 2001 started off with our first Annual program review on the morning of January 11 followed by the second meeting of the BAE Advisory Board. Members of the BAE faculty made a brief presentation on their research and teaching accomplishments in 2000 and plans for the year 2001. This review program was attended by Extension Engineers, administrators of the UofA Division of Agriculture and some BAE Advisory Board members. Our next program review will be January 2002.

The weekly Brown-Bag Program initiated in Fall 2000 continued in Spring 2001 with guest speakers in Computational Biology, Auto Immune Technology, ABET Assessment, Recruiting and Retention, and other relevant topics. A brown-bag program was also arranged to meet with Recruiting Coordinators and staff of the University; College of Engineering; College of Agricultural, Food and Life Sciences; and Pre-Med Program to discuss the UofA Biological Engineering program.

Significant progress has been made with the construction of new lab rooms for research and teaching in our laboratory facility at the Central Research and Education Center. This project is expected to be completed in the Fall and will provide high-quality space for the activities of our growing faculty.

Dr. Yanbin Li joined the department as Associate Professor from Poultry Science November 1, 2000.

ASSESSMENT PLAN FOR BIOLOGICAL AND AGRICULTURAL ENGINEERING

The BAEG Department has prepared a detailed assessment plan as part of the Continuous Quality Improvement Program required by our accrediting agency, the Accreditation Board for Engineering and Technology. The assessment plan is described in Appendix A.

Specific items from the Academic Policy Series, 1630.10 are addressed below, and related to the assessment plan described in the Appendix.

2. ***Each plan will identify the specific goals which the unit has established for students earning degrees under its auspices.*** Specific Goals for our students are addressed throughout the appendix, as outcomes A through K. Questions addressed are:

a. ***What are we attempting to do for our students?*** Again, outcomes A through K in the Appendix answer this question.
b. ***How well are we doing what we are attempting?*** In the discussion of each outcome in our CQI Plan, there is a section describing the methods used to assess how well our students are doing.
c. ***What might be modified to make it better?*** In the discussion of each outcome, there is a section called "Feedback", in which we discuss the methods through which our assessment data can be used to lead to improvements in the program.

3. ***Each plan will require that undergraduate students in the unit be assessed during students' last year before graduation.*** Our students are assessed throughout the curriculum, but they are specifically surveyed through the "Exit Interview" in their last semester.

4. ***Each plan for undergraduate students will require that assessment include at least two of the following techniques***.

a. ***A standardized examination***. The Fundamentals of Engineering Exam is one of our assessment tools.
b. ***A comprehensive or exit examination for student majors created and graded by faculty in the assessing unit***. We do not have such an exam.
c. ***Exit interviews with all graduating students***. As mentioned before, we use an exit interview of all graduating seniors in their last semester.
d. A specific project appropriate for use in assessment … Each of our students must complete a comprehensive project as part of our Capstone design course. These projects are well-suited for use in assessment.
e. ***A senior seminar or capstone course appropriate for use in assessment***. All of our students complete such a capstone course, which among other requirements includes a detailed engineering report used by the faculty to assess the capabilities of the students. These reports are also submitted to a national design competition.

f. ***An internship or clinical experience …*** We do not have such a requirement.
g. ***A student portfolio appropriate for use in assessment.*** Departmental faculty collect examples of student work in all classes. These examples constitute "course" portfolios, rather than "student" portfolios, although they can be rearranged so that each student's work is grouped, if desired.

5. ***Plans for graduate or professional students will require assessment, late in the students' programs, by at least two of the above techniques***. All of our graduate students must pass written and oral exams late in their programs of study. In addition, every graduate student must prepare a written paper suitable for submission to a refereed journal as part of our requirements for both our M.S. program and our Ph.D. program.

6. ***Each plan will require that another assessment of students be made no sooner than three and no later than five years after the students graduate. This assessment will be in the form of a questionnaire or interview and will concentrate on how effective the work at the University has been in preparing the student for his or her career***. All of our alumni are surveyed by such a questionnaire within the time period stated.

7. ***Each plan will require that, on an annual basis, a committee of faculty from each unit evaluate the results of that year's assessments of students and alumni. The committee will report its findings and conclusions to the unit's faculty, including recommendations (if any) concerning changes in the curriculum, teaching assignments, and other aspects of the program.*** Part of our CQI program, discussed in Appendix A, is an annual faculty retreat, in which all of our faculty review our teaching program, including student assessments, and recommend changes.

8. ***Each unit plan will be adopted by the faculty and chairperson of that unit and approved by the Dean of the College or School and by the Vice Chancellor for academic affairs***. Our plan has been so approved.

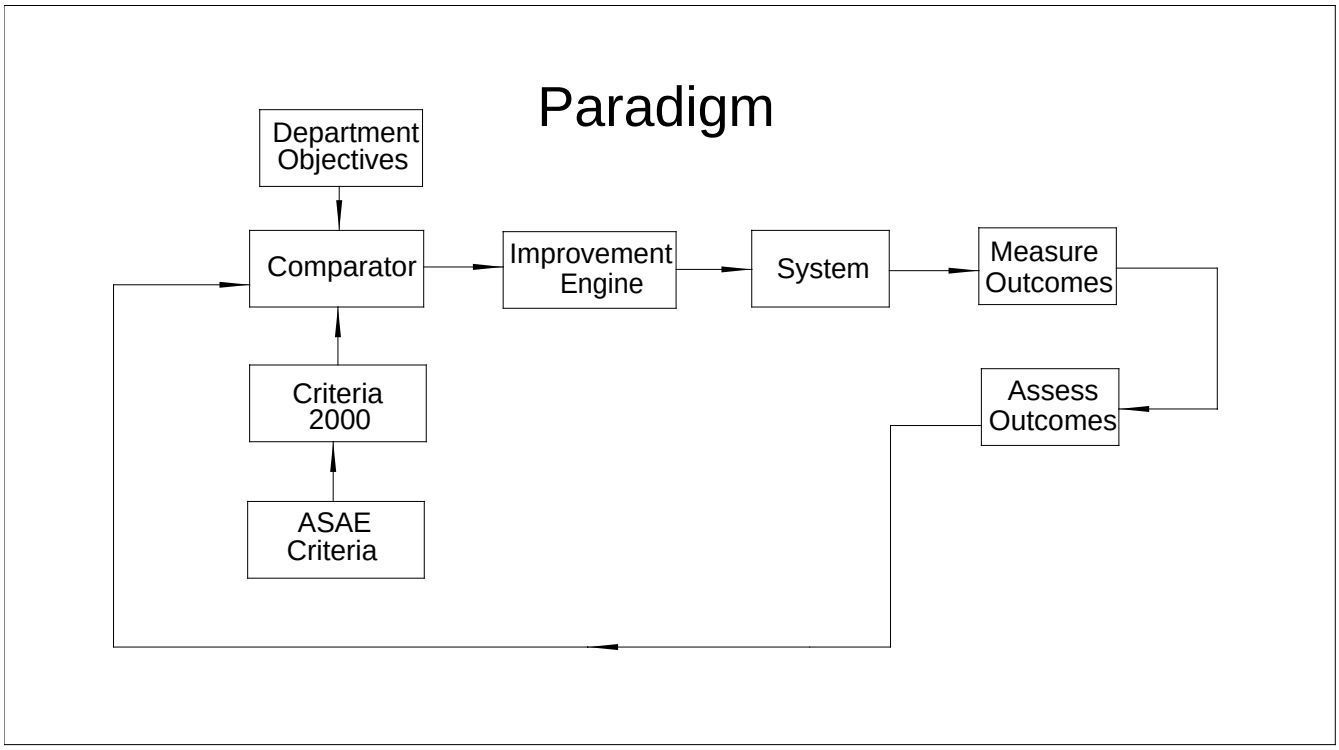
9 ***Each college or school will establish a committee charged with periodically evaluating and reporting on the effectiveness of the assessment plan of its units***. The College of Engineering and the Dale Bumpers College of Agricultural, Food, and Life Sciences both have such committees.

Appendix A

Biological and Agricultural Engineering Department
A Continuous Quality Improvement (CQI) Program

As required by ABET for Accreditation
A paradigm for our Continuous Quality Improvement program.

Important aspects of our process for high quality and continuous improvement are our ability to measure our current performance and use this information to effect changes. The idealized feedback control system shown below illustrates the thought processes through which we hope to achieve our objectives.



OUTCOMES (A through K)

A. We must demonstrate that our graduates have an ability to apply knowledge of mathematics, science, and engineering. [Revised 3/26/2001]

Engineering is the art or science of making practical application of the pure sciences, such as mathematics, physics, chemistry, and biology. All graduates of the program should have knowledge in the pure sciences and the ability to apply that knowledge to the solution of theoretical and practical problems. Set points for measuring this knowledge and ability are:

Set Points

1. Our students will do well in the required courses in the pure sciences.
2. Our students will achieve acceptable scores in the recently adopted and standardized "Rising Junior " examination given at the University of Arkansas
3. Eighty percent or more of our students who take the Fundamentals of Engineering examination before graduation will pass it.
4. Our students will have documentation in the form of "portfolios" that contain significant examples and exercises in applying pure science to the solution of realistic problems in BAEG courses.
5. Fifty percent or more of our graduates will become registered as professional engineers and retain their membership in an appropriate professional society.

Improvement Engine

1. The improvement engine will include all faculty members and current students.
2. Each instructor should get students to assist in creating portfolios for every class. The nature of the portfolios, however may be different for each instructor.
3. In classes in which topics of importance on the FE exam are taught, the instructor should alert the students each time one of the topics is introduced.
4. We should focus on our capstone design course even more as a way of evaluating the outcomes demonstrated by our students.

Measuring Outcomes

1. Instructors and advisors will monitor the performance of first and second year students in the pure science and basic engineering courses, based upon grade reports received for every student.
2. The faculty will monitor the scores in the "Rising Junior" examination. This data will be circulated to the faculty.
3. The faculty will review the notebooks or portfolios prepared by our students. This will be done by selecting several portfolios for discussion at the faculty retreats.
4. The faculty will review the results of the Fundamentals of Engineering Exam based upon data circulated to the faculty.

Assessing Outcomes

The data collected will be studied and analyzed at the annual faculty retreat.

Feedback

1. Deficiencies noted in the performance of our graduates in the Fundamentals of Engineering examination will be used to determine which of our undergraduate courses need improvements.
2. In particular, the content of required BAEG courses will be evaluated to ensure that key subjects, such as psychrometrics, properties of materials, and others are being

adequately covered. Design problems that require the application of key engineering fundamentals will be continually re-evaluated.
3. Information from student notebooks will be used to modify and improve BAEG courses.
4. BAEG courses will be modified in response to input from graduates engaged in professional engineering.

B. We must demonstrate that our graduates have an ability to design and conduct experiments as well as to analyze and interpret data. [Revised 4/9/2001]

Set Point

All of our graduates will be required to develop means to test designs or processes and/or to integrate and utilize existing data in their jobs. Thus, our set point is simply:

Our graduates will be able to design and/or conduct experiments and to analyze and interpret data.

Improvement Engine

The improvement engine will include our classes, especially the laboratory sections and our out-of-classroom experiences provided by our research programs. Thus our set point will be reached in a variety of ways:

1. Many students in our department will be hired to assist in lab and field-scale experiments that are part of our active research program. In most of these jobs, and especially for students who work for several years, they will be exposed to statistically designed experiments that are conducted according to strict protocol. Analysis and interpretation of the data is typically part of the job.
2. Most of our upper-level classes, as well as some of the introductory ones require analysis and interpretation of data. This includes such tasks as searching for and interpreting design parameters, material property values, and functional relationships between biological variables.
3. Most of the laboratory sections in BAEG courses include setting up and conducting experiments. These experiments complement the theory discussed in the classroom. In addition, some of the laboratory classes include tours of local processing plants, where data are collected for analysis and interpretation.
4. Two undergraduate journals are published on campus. Our students will be encouraged to submit the results of their research projects to these journals.
5. Observations by the faculty have indicated that students tend to search only the web for references, limiting their exposure to refereed journal articles. Some assignments will be modified to require students to find and submit copies of journal articles in the library or in full-text on-line journals.

Measuring Outcomes

Some of the things we can measure include:

1. The number of graduates obtaining jobs based upon design and/or development of devices, systems, or processes. The demand for our graduates should reflect the reputation of our program for producing graduates with these skills.
2. The number of graduates who enter and successfully complete graduate degree programs. Again, the success of these students should be an indicator of our success in preparing them for research-based careers.

3. The number of formal reports, professional engineering reports, journal articles and/or presented papers by our undergraduates. This number will be an indicator of the success of our students in performing research and analyzing their data.
4. Student notebooks and/or portfolios will contain examples of successfully completed design projects from several of our courses. These can be examined at the annual retreat.

Assessing Outcomes

The numerical data described above will be summarized and presented at the annual faculty retreat. In addition, the notebooks for some of the students can be studied to determine whether they are capable of performing at the desired level.

Feedback

Based upon the results of our discussions at the retreat, faculty will review the courses in which these skills are being taught. Improvements will be recommended by these faculty to the curriculum committee.

C. We must demonstrate that our graduates have an ability to design a system, component, or process to meet desired needs. [Revised 5/14/2001]

Set Points

Each graduate of the program should be able to document that he or she has actively and effectively participated in design of systems, components and/or processes. Instructors of each undergraduate BAEG class will identify activities containing design and require students to keep certain records of these activities. In all design activities the concepts of documentation, standards, ethics, safety, and economics will be incorporated.

Improvement Engine

Design skills for the BAEG graduates will develop through courses with a mix of engineering science, design experience and exposure to design methods in industry. Instructors will seek opportunities to enrich courses at all levels with open-ended design problems (without reducing technical science content). The goal is to present a slate of courses in which design becomes the means of application for the engineering science presented.

1. Students will record personal design activities in a "student log." The student log will serve as a record of quantity and quality of day-to-day design work for each particular class project and will be used by the instructor as an evaluation tool for grading.
2. Each semester, instructors will gather examples of students' design work and put them into a collection. Instructors who prefer to do so may place these into portfolios for each student. Instructors may, as an alternative, pool all the examples into a "portfolio" for the class as a whole.
   Students will be encouraged to place samples of best work from design and other efforts into a student portfolio. These "promotional" portfolios may be used by students in interviews for graduate school/employment.
3. The faculty will review student notebooks, and instructor-created class "portfolios" and individual portfolios. These documents will be used by faculty in reviewing the quality of student's work for scholarship or graduate school application, recommendation for employment, or general evaluation of program effectiveness.
   Our two-semester senior design sequence will require thorough reporting and completion of a two-semester design project, including construction and evaluation of

a prototype, if appropriate. For mechanical design projects, the resulting report and evaluation will be submitted by the student teams for the ASAE/AGCO Student Design contest. In the case of more conceptual projects, such as process design, in which prototype construction is not feasible, project reports will be evaluated by industry representatives, or other non-academic groups. Some projects, such as those related to the environment, may be evaluated or validated by comparison with simulation models.

4. Our capstone design sequence will focus primarily on the team design concept. This two-semester sequence takes the teams through a "complete" design process from defining the problem to evaluating a prototype or concept.. Emphasis will be placed on developing "team" skills. Regular scheduling/reporting sessions will be planned. Teams will be evaluated by the instructor and, periodically, by faculty teams. Individual performance will be evaluated by the instructor and by team peers.
5. All other BAEG courses regularly include smaller-scale, but equally important, design projects. These courses will serve to present engineering sciences as the tools of the engineer. Design will be presented as the method.
6. ????Our two-semester freshman introductory courses will coordinate with the senior design sequence to allow freshmen to see what the senior design projects are like. ????
7. Tours of industry, with exposure to design, manufacturing, and processing methods will be organized for our students.

Measuring Outcomes

Success of the curriculum in presentation of engineering concepts will be measured through:

1. Student portfolios
2. Student logs from individual classes
3. Surveys of graduating seniors and graduates

Assessing Outcomes

1. A Faculty panel will review logs, notebooks, instructor-created portfolios and survey data. Recommendations for improving the design experience will be made to the department head annually by the panel.
2. An annual planning session (retreat) by department faculty will coordinate changing needs in the curriculum and consider changes in presentation of design concepts.
3. Consultation with the Department's Advisory Board will provide additional input to the continued improvement in design presentation.

Feedback

Changes to design presentation and content of the curriculum will be discussed at annual faculty retreat. Individual courses will be modified by instructor(s) as recommended.

D. We must demonstrate that our graduates have an ability to function on multidisciplinary teams. [Revised 6/5/2001]

Targets

Each graduate of the program should be able to document that he or she has already functioned effectively in multidisciplinary teams within the curriculum, as evaluated by student peers and course faculty. Additionally, graduates of the program should demonstrate at least an "above average" ability in this area, as evaluated by employers, in comparison to engineers from other

programs.

Improvement Engine

1. The curriculum includes, or will include, numerous experiences in which students are required to function on multidisciplinary teams, as follows:
2. Several courses (e.g., our two-semester freshman sequence) have previously included numerous cooperative learning activities, in which students are compelled to function in instructor-assigned teams, both in and out of class. The first freshman course includes a significant focus on the principles of teamwork, including activities with outside resources on group dynamics, personality typing, exercises in group communications, and project participation with a senior/graduate course in Product and Process Development. This last activity included engineering, food science, and law students.
3. Our graduate-level course on Product and Process Development is a multidisciplinary course that has previously included students from BAEG, Food Science, and Poultry Science, working in cross-functional teams on industry-sponsored projects. Although this course is not currently required in the undergraduate curriculum, it will be used as a model for increasing this type of activity in other courses within the required curriculum, and a greater number of undergraduates will also be encouraged to take this course.
4. Several courses (e.g., the freshman sequence, our biosystems introductory course, and the machinery design sequence) include projects with significant non-engineering components (e.g., regulatory, social, and marketing issues). Future offerings of these courses will include integrated activities with students from non-engineering courses (e.g., Food Science, Marketing, Sociology, etc.), working with the engineering students on these projects. The instructors of these and other courses will seek out and arrange for cooperation with instructors from other relevant disciplines, in order to ensure, enhance, and evaluate the ability of our students to function on multidisciplinary teams.

Measuring Outcomes

The following tools will be used to measure the ability of students and graduates to function on multidisciplinary teams:

1. *Peer evaluations* have been previously used in several courses as a means to measure effectiveness in team activities. The evaluation instrument will be used in other courses as cross-functional team activities are further integrated into the curriculum.
2. *Instructor evaluations* will also be used to evaluate the effectiveness of every student, with respect to multidisciplinary team activities in the respective courses.
3. *Industry evaluations* will be used, in the various courses that include industry-sponsored projects, to gather opinions from industry clients regarding the ability of the students to work effectively on the industry-sponsored teams.
4. ***Employer surveys*** will also be used to evaluate the abilities of graduates to function on multidisciplinary teams within their respective work environments.

Assessing Outcomes

The results of peer, instructor, and industry evaluations will be compared, over time, to the results of employer surveys. This will help determine whether the department's evaluation of effectiveness in this area corresponds well with the graduates' abilities, as demonstrated in the

workplace. Additionally, evaluations for randomly-selected students will be tracked through the curriculum and into the workplace to assess whether the curriculum is indeed improving upon the abilities and skills of the individuals.

Feedback

The results from the assessment will be evaluated by the faculty at the annual retreat. The methodology for incorporating multidisciplinary activities into the curriculum and/or the amount of such activities will then be appropriately modified, seeking to enhance the measurable levels of improvement in this area.

E. We must demonstrate that our graduates have an ability to identify, formulate, and solve engineering problems.

Engineers are problem solvers. Thus, the ability to identify, formulate, and solve problems is fundamental to the entire profession. The targets are straightforward.

1. Our graduates will be able to examine the facts and data with respect to a given situation and identify problems that can be solved by application of the fundamental laws of science and math.
2. Our graduates will be able to extract pertinent data from the information available for a given problem or situation, gather additional data, if required, identify the principles needed for a solution, and formulate the procedure for finding an optimum solution, if one is possible.
3. Our graduates will be able to generate a series of solutions to a particular engineering problem, study the results, and identify the "best" solution.

Improvement Engine

The improvement engine includes all of the basic math and science courses, the engineering science courses, the engineering design courses, and the faculty of the department and the College of Engineering.

Measuring Outcomes

1. The notebooks and portfolios of our students will contain examples of solved engineering problems.
2. The notebooks and portfolios will contain examples of design projects that incorporate the identification, formulation, and solution of engineering problems.

Assessing Outcomes

The notebooks and portfolios of our students will be studied at the annual faculty retreat to confirm that our students are capable of identifying, formulating, and solving engineering problems.

Feedback

Any deficiencies noted in our students' capabilities during the review at the annual retreat will lead to revisions in assignments or revisions in subject matter content of the courses taught in our program.

F. We must demonstrate that our graduates have an understanding of professional and ethical responsibility

In order for our graduates to become responsible leaders, they must gain an understanding of the special professional and ethical responsibilities demanded from engineers. Professionalism and ethics are integrated into our program through course work, extra-curricular activities and

mentoring by faculty and industry engineers.

Targets

The targets for professionalism and ethics are:

1. All graduates will have a general knowledge of professional registration (purpose, requirements, procedures), professional societies and the engineering code of ethics.
2. Specific instruction in Case Studies in Engineering Ethics will be provided in the Senior Seminar course.
3. The rate of participation by our graduates in the following professional activities shall be superior to that of graduates from peer institutions: active participation in professional societies, and seeking and acquiring professional engineering registration.

Improvement Engine

1) The required understanding will be provided through the following program features:
   a Initial awareness of professional societies, professional registration and engineering ethics will be introduced to students in the freshman Design Fundamentals classes.
   b Professional responsibilities and engineering ethics will be further developed in the two sophomore classes in Quantitative Biology, the two junior classes in Process Design, and the two senior classes in Design.
   c Professional engineering activities are included in extra-curricular student activities, namely membership in Student Branch of ASAE, invitation of professional engineers as speakers, submission of student designs to the national design competition, and support of students attending state and national technical and professional society meetings.
   d The importance of professionalism and ethics will be demonstrated to the students by faculty example, through their attainment of professional registration and leadership roles taken in professional societies.
   e The importance of professionalism and ethics will be demonstrated to the students by examples of engineers in industry, through their contact with students as speakers, on field trips, at professional meetings, or as participants in student design projects.

Measuring Outcomes

The success of the program in meeting these goals will be measured by the following:

1. Student notebooks will include examples of student responses to examination questions (short essays) which probe the students' understanding of professional responsibility and engineering ethics.
2. **Surveys of graduates** will provide a sample for measuring the rates at which our graduates seek and attain professional registration, and become actively involved in professional societies.

Assessing Outcomes

Given these data, the program will be evaluated relative to the established goals by industry leaders from the Department's **Advisory Board** and by faculty, who will review the data and provide evaluations at their annual retreats. Evaluations will include recommendations for changes, if necessary, to improve the Program's success in realizing the goals. Specific recommendations for changes will be sought in the following areas:

1. Materials and activities used in course work
2. Nature and frequency of extra-curricular activities
3. Methods for professional mentoring of students by faculty and industry engineers.

Feedback

The industry and faculty evaluations will be used at the faculty retreat to make plans to implement the suggested changes to the Program.

G. We must demonstrate that our graduates can Communicate Effectively.

Our goal is that our graduates demonstrate exemplary communication skills, both written and oral. Thus, the following set point.

Set Point

Every graduate of our program will be able to present information, both written and oral at a level of skill such that the information will be understandable to the audience for which it is intended.

Improvement Engine

While realizing that some students will possess handicaps that limit their oral communication abilities, we will assist our students in developing outstanding communication skills in several ways.

1. In each class taught in the department, the requirements will include an oral presentation involving each student.
2. While semester projects will often be team oriented, with one written report per team, progress reports or additional smaller project reports will ensure that each individual's writing skills are tested.
3. We will continually improve the laboratory and lecture portions of our courses so that they teach not only effective engineering, but how to effectively communicate that work to others, both engineer and non-engineer.

Measuring Outcomes

One of the outcomes for which we will look is how our students' communication skills compare to those of others within the University. One way that this will be accomplished is by arranging with the Department of Communication to evaluate randomly selected written and oral presentations. A second way is by having the other students in the class evaluate the oral presentations. A third way is by having guests of other faculty within the department attend and evaluate the oral presentations. Finally, we will examine the results of the Rising Junior exam with respect to communication skills.

Another outcome for which we will look is how our graduates' communication skills compare to those of others within their company, both engineers and non-engineers. This will be accomplished by the **surveys of graduates and employers**.

Assessing Outcomes

All of the outcome data will be included in the students' notebooks for the annual faculty retreat. The faculty will discuss strengths and weaknesses as viewed by the different groups of evaluators.

Feedback

From the discussion at the annual retreat, improvements can be made. These improvements can include alteration of the requirements for the next time a specific course is taught. The improvements can also include targeting specific students or groups of students for attention in subsequent classes in the department. For example, the number and complexity of written reports could vary depending on the skill level of the incoming students.

H. Our program must demonstrate that our graduates have the broad education necessary

to understand the impact of engineering solutions in a global/societal context.

It is important that engineers understand the impact of their work on their society. It is not an exaggeration to say that life and death sometimes rest upon the decisions an engineer makes. Thus, an important purpose of our educational program is to foster in our graduates a broad educational background, in addition to their engineering skills and knowledge. Our graduates must have an understanding of such areas of knowledge as history, sociology, economics, philosophy, and many others.

Targets

1. Our graduates will complete the requirements imposed by the University for the "State Minimum Core", as modified for the College of Engineering.
2. Our graduates will complete any additional courses beyond those in the "minimum" requirements if needed to broaden their education. This need will be determined by the faculty, consistent with the objectives of the University, the two Colleges, and agencies such as ABET and ASAE.
3. During their tenure in the Department, our students will have the opportunity to interact with practicing engineers who can discuss the societal/global impacts of their work.
4. Students in the Senior Seminar will make presentations demonstrating their understanding of some societal issues.

Improvement Engine

A major component of the improvement engine is the faculty. Their understanding of the broad issues relating their work to the society around them will be conveyed to their students. This transfer will begin in the first course taught in the department and continue throughout the curriculum. The department will encourage the faculty to continue to develop broad expertise and knowledge. To facilitate this continuing education, the Department will sponsor invited seminars, encourage industrial contacts, encourage faculty to attend continuing education functions sponsored by ASAE and other professional societies, and publicize information related to the development and applications of a broad range of knowledge.

Among the course requirements in the "minimum core" are included as options many courses in the social sciences, the humanities, and fine arts. In addition, the requirements include a course in the History of the United States or in Political Science. This will not guarantee that they gain understanding, but our students will have the educational background needed.

In addition, the faculty will encourage each student to realize the importance of knowledge and understanding in very broad areas. This encouragement will begin immediately upon entry into our program. The encouragement will take such forms as:

1. Classes
2. Field trips, touring industry, farm, and government lab facilities.
3. Direct contact with people working in different disciplines.
4. Participation in professional societies or clubs.
5. Encouraging students to read at least one newspaper each day and to read at least one newsmagazine on a regular basis.

Measuring Outcomes

The outcomes of our efforts may be measured as follows:

1. Each student will have a Matrix of Accomplishments that will include the completion of courses intended to broaden the educational experience.

2. The exit interview conducted for each student can elicit information about the breadth of the education achieved, and the understanding gained.
3. A review of the notebook for each student will demonstrate that each has developed an awareness of her/his potential impact on society.
4. **Surveys of alumni, employers, and the Advisory Board** will be used to determine whether the breadth of the educational program and the understanding achieved are adequate.

Assessing Outcomes

The question of breadth in our educational program will be addressed when the Matrix of Accomplishment is reviewed along with the notebook for each student. In addition, the surveys of alumni, employers and Advisory Board members will be summarized and discussed.

Feedback

Changes needed to improve our educational program with respect to this requirement will be recommended to the faculty by the curriculum committee.

I. We must demonstrate that our graduates have a recognition of the need for and the ability to engage in life-long learning.

Targets

Students and graduates will be expected to demonstrate this quality.

Improvement Engine

1. The Faculty will encourage student participation in professional societies and the related student clubs. The faculty advisors will also encourage students to invite representatives from industry to present seminars, round table discussions and other forums designed to better prepare students for future employment. The importance of life-long learning will be discussed at these events.
2. The importance of life long learning will be emphasized and illustrated using some BAEG design projects where students will not be given all of the information they need to solve a problem, but will have to search for and find some of the information on their own.

Measuring Outcomes

The following tools will be used to measure students' recognition of the need for and the ability to engage in life-long learning:

1. Questionnaires will be given to students after attending a lecture or seminar presented by an invited speaker from industry. These seminars will include those organized by the student branch of ASAE or those presented in the required Senior Seminar Class. These questionnaires will include questions related to the presentation and designed to reveal whether or not the student was given insight about the need for engaging in life-long learning, the importance of being able to work on teams and/or professional and ethical responsibility.
2. **Senior Exit Interview**: During the senior exit interview, students will be asked questions designed to reveal whether or not the student recognized the need for engaging in life-long learning.
3. **Alumni surveys**: Questions regarding attendance at professional meetings and in any activities related to continuing education will be included in questionnaires sent to alumni.

Assessing Outcomes
The results of the surveys and questionnaires sent out to students and alumni will be summarized.
Feedback
The outcomes of the surveys and questionnaires will be evaluated by the faculty at the annual retreat. At this point, the need for program modification will be determined.

J. We must demonstrate that our graduates have a knowledge of contemporary issues.
Targets
Students and graduates will be expected to demonstrate this quality.
Improvement Engine

1. A controversial, contemporary issue will be examined in the freshman classes. Student teams will list the perspectives involved, then listen to presentations from invited representatives of each perspective. The students will prepare a report summarizing the world views and perspectives of different individuals and groups.
2. Students in the freshman classes will be required to periodically review current events via various news periodicals. A current event quiz will be given once per month. At the end of the semester, the student(s) with the highest score on these current event quizzes will be given an award.
3. This same current events quiz will be sent out to all the undergraduate students in the department by E-mail as a contest every semester. The winner of the contest will be given an award. The contest is intended to encourage students to keep up the good habits developed in the Freshman classes.

Measuring Outcomes
The following tools will be used to measure students' knowledge of contemporary issues:

1. Student reports.
2. Senior Exit Interview: During the senior exit interview, students will be asked a few questions about contemporary issues.
3. Results from the current events quizzes.

Assessing Outcomes
The degree of participation in the current events contests and the results of the exit interviews will be summarized. Representative student reports and quizzes will also be compiled for evaluation.
Feedback
The outcomes of the exit interviews, contests, reports and quizzes will be evaluated by the faculty at the annual retreat. At this point, the need for program modification will be determined.

K. We must demonstrate that our graduates have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
First, we need to identify the modern engineering tools necessary for engineering practice. To some extent, this definition is contingent upon the degree of specialization of each student, so we have to be somewhat general. The list of modern equipment would have to include, however, the following:

1. Recent desk-top computers.
2. Recent electronic control systems.
3. Recent software such as word processors, spreadsheets, CAD systems, simulation

systems.

Targets

1. Our students will use in their studies the most recent personal computers available.
2. Our students will use in their laboratory courses the most recent technology for electronic sensing and control.
3. Our students in all of their classes will use advanced software for personal computers, including the word processors, spreadsheets, and CAD programs commonly used in industry at that time.

Improvement Engine

Providing the most recent hardware and software for our students will be challenging in these times of tight budgets. Fortunately, however, each of our students pays an engineering lab fee, part of which is returned to the Department and can be used to help keep up with the latest developments. In addition, the large research program managed by the Department means that recent hardware and software will be purchased as part of many projects, and these items can be shared with our teaching program.

Measuring Outcomes

Several outcomes need to be measured.

1. Have we correctly defined what are the latest hardware and software being used in the pertinent industries? We can get a handle on this through **surveys of alumni and employers**. In addition, our interactions with other departments through our professional societies will give us some helpful feedback.
2. Are we providing an appropriate level of access by our students to the latest in technology?

II. ACHIEVEMENTS IN TEACHING, RESEARCH AND PUBLIC SERVICE

The newly revised undergraduate curriculum was approved as B.S. in Biological Engineering effective Fall 2001.

Lalit R. Verma served as an ABET evaluator for the Biological System Engineering program at University of California, Davis in Fall 2000.

"Distinguished Engineer Award for 2000" was presented to Lalit R. Verma on May 17, 2001 at the Annual Meeting of the Louisiana Section of ASAE in Natchez, MS by Wendall Meaux, Chairman of La. Section of ASAE.

III. ACHIEVEMENTS OF STUDENTS AND ALUMNI

Four student design projects were submitted to the ASAE National Student Design Competition. One project was selected to compete in the finals at the ASAE National Meeting in Sacramento, August 2001. Six of the eight student team members will attend the meeting and present their design project.

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Include only those articles published, submitted or in press. Articles submitted or in press should be indicated as such. Do not submit articles in preparation.

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   Include only publications having an external peer review. For AES publications, include only AES Research Bulletins not Research Series or other non-refereed AES publications.

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DEGREES AWARDED

BS: 7
MS: 1
Ph.D. 2