I. A Framework for the Planning Model

The actual quality of a program and the perception of that quality are important components of an excellent engineering school, as well as an excellent university. The elements of an excellent school include (1) an excellent and committed faculty, staff, and administration, (2) superior and sufficiently large student body, (3) state-of-the-art laboratory equipment and computing facilities, and (4) comprehensive and relevant curriculum.

Here, we focus on the role of EC 2000 in improving program excellence. A program is described by the program objectives, program outcomes, and program curriculum. A program that meets the spirit of EC 2000 assures that the answers to the following questions are affirmative: Do we know what we do? Do we do it well? Can we prove it? Do we improve it through periodic assessment and evaluation?

Program Objectives. Program objectives are broad, general statements that describe how the program will satisfy constituencies’ needs in the most general terms possible. Objectives must be consistent with the mission of the university, school, and department, as well as the EC 2000.

Program Outcomes. Program outcomes describe what the program’s graduates will know and be able to demonstrate upon graduation. Program outcomes provide the link to the program curriculum and they relate to program educational objectives as well. Program outcomes should include those outcomes described in criterion 3 of the ABET criteria for accrediting engineering programs, as well as outcomes unique to the character of the institution.

Program Curriculum. The program curriculum, expressed through a combination of courses, which each student is to complete, must address all program outcomes for the program. Furthermore, the curriculum must be in compliance with criterion 4 (professional component) and criterion 8 (program criteria) of the ABET accreditation requirements.

II. Program Educational Objectives

ABET requires that each engineering program has detailed program objectives in place and a process in which the objectives are determined and periodically evaluated. The results of evaluations are to be used to further improve the program educational objectives and the educational process. Therefore, the program educational objectives system consists of three subsystems: the system used to determine objectives of the program, the system used to evaluate objectives, and the system used to improve the program effectiveness.
II.A. Determining Program Educational Objectives

The Assessment and Evaluation Leadership Committee, consisting of department chairs, associate dean, and dean, drafted a set of program educational objectives after receiving input from each of the departments’ faculty. The draft was presented to the faculty for their review and comments. After a daylong planning meeting, the faculty approved a set of six program educational objectives that are common to all the engineering degree programs. The objectives were then reviewed and approved by the School of Engineering Presidential Advisory Council (SEPAC) consisting of leaders from industry, business, and government. Below are the approved program educational objectives:

1. Prepare students for entry-level positions and graduate school.
2. Prepare graduates who have a broad background in fundamentals and the ability to solve problems.
3. Prepare graduates who possess technical proficiency and sound judgement.
4. Prepare graduates who are competent in written and oral communication, and computer proficiency.
5. Prepare graduates who have an understanding of professional issues such as economics, ethics, teamwork, and leadership.
6. Provide a stimulating environment and promote life long learning.

II.B. Evaluating Program Educational Objectives

In order to continually improve the quality of our engineering programs, it is essential to periodically evaluate our program educational objectives for the purpose of finding (a) if these are the program educational objectives expected by the programs’ constituencies, (b) if the educational program offered at the University accomplishes these objectives satisfactorily, and (c) how the programs’ effectiveness can be improved. We believe a six-year cycle to review and revise the program educational objectives is the right cycle. The faculty of the School of Engineering has agreed upon three common evaluation tools to be used by all the programs offered within the School of Engineering. These are alumni surveys, graduating senior surveys, and results of outcomes assessments.

Each program faculty will utilize the above evaluation tools, but can add additional evaluation tools for their program. Other evaluation tools could include departmental industrial advisory committee and focus groups for alumni, seniors, or employers. Although the University is ultimately responsible for the program educational objectives, the knowledge and expertise that is required to make this decision rests with the program faculty. The program faculty collects the information, both qualitatively and quantitatively, from each of the appropriate constituencies and makes the appropriate adjustments to the program educational objectives.

In an effort to obtain the views of the graduates about our program educational objectives, we surveyed the alumni of 1996 and 2000. In the survey, alumni were asked to evaluate the quality of their education with respect to the six program educational objectives established by the School of Engineering. In the second part of the survey, they were asked to indicate their
opinion of the importance of the set of attributes for an engineering graduate. These attributes are based on the elements of the program educational objectives.

The responses were very favorable to our program offerings. In response to the question regarding the appropriateness of our program educational objectives, most of the responses were good to excellent.

II.C. Improving Program Educational Objectives

In order to continually improve the quality of our programs, it is important that the results of the evaluation process be used to improve the effectiveness of each of the degree programs. Because of the time it takes for the changes to be implemented and their effect to be measured in graduates’ performance, changes in the program educational objectives are considered only on an infrequent basis.

III. Program Outcomes

Program outcomes describe what the graduates will be expected to know and be able to do upon completion of the degree program. In essence, student outcomes refer to those aspects of the students’ development that the institution either does influence or attempts to influence through its educational programs and practices. The engineering program outcomes must include the eleven outcomes specified in criterion 3 of the criteria for accrediting engineering programs. In addition, there should be program outcomes which address the unique qualities of the program in the context of our university.

The program outcomes subsystem of our planning model consists of the following three elements:

1. Determining program outcomes,
2. Assessing program outcomes, and
3. Improving the program based on the assessment results.

III.A. Determining Program Outcomes

The Assessment and Evaluation Leadership Committee (AELC) led the effort to make our programs compliant with the criteria for accrediting engineering programs in the United States. Below is a summary of the steps involved in determining the program outcomes for each of our engineering degree programs:

The AELC reviewed the program outcomes listed in criterion 3 of the criteria for accrediting engineering programs, as well as the University of Portland’s common core curriculum document to develop a set of school-wide program outcomes. The draft list was then presented to the SEPAC for their review and comments. Finally, the draft was presented to the entire engineering faculty for discussion and approval. The final product of this effort was a set of 12 school-wide program outcomes, the EC 2000 a-k and “an ability to develop a sense of personal, social, and moral responsibility.”
The faculty customized the 12 school-wide outcomes to their individual degree program. This required an expansion and further explanation of what each of the outcomes meant to the specific program.

The faculty of each program also mapped their program outcomes against the program educational objectives to ensure compatibility. Furthermore, a matrix of program outcomes against courses required in a program curriculum was developed. Curricula were reviewed/revised to ensure all program outcomes were addressed by the particular curriculum. For each course, the faculty member responsible prepared a set of course learning objectives.

III.B. Assessing Program Outcomes

In order to assess whether the program outcomes are achieved by the students who complete our programs, we looked at a number of program level assessment tools. After much discussion, the engineering faculty agreed to use the following assessment tools: (1) graduating senior surveys, (2) alumni surveys, and (3) student transcripts.

In addition to these school-wide assessment tools, a number of other program level assessment tools were identified; namely, capstone senior design projects, nationally recognized examinations such as Fundamentals of Engineering exam, discipline specific comprehensive exams, employer surveys, placement data of graduates, students’ participation and performance in regional conferences and competitions.

The faculty of each program utilize the three school-wide assessment tools plus additional program specific assessment tools to ensure that our graduates master the 12 program outcomes for the program they pursue. Furthermore, the data gathered by implementation of program assessment are used to improve the quality of our educational enterprise.

III.C. Improving the Program Based on Assessment Results

The assessment of program outcomes leads to further development and improvement of the program. The purpose of applying assessment instruments (both internal and external) is to gather data that can be used 1) to document the success of the particular educational program in assisting students to achieve the desired outcomes, and 2) to identify aspects of the program which may need improvement. The overall purpose of our planning in the School of Engineering is to continually improve the quality of our programs. Hence, each program utilizes the results of implementing school-wide assessment tools, as well as programmatic assessment tools to further improve the quality of the particular educational program.

Many of the assessment instruments are designed to assess more than one outcome. The relationship between the assessment instruments and outcomes is determined in each of our degree programs. The results of all assessment activities are included in an annual report by each program faculty. Actions taken to improve the program are based on the results of assessment as documented by each faculty at the end of each academic year.
IV. Program Curriculum

The program curriculum for each of our degree programs is designed as a set of courses of study that provide for the logical development of the student knowledge and skills. The criteria for accrediting engineering programs require an outcomes based curriculum. In designing our curricula, we ensure that each course contributes to the program outcomes.

For every course, a set of course learning objectives are developed. The learning objectives are a set of statements that describes how each course satisfies one or more of the program outcomes and are delivered to students as part of the course syllabus.

The intent of learning objectives is to clarify what is expected of students (a) in language that is clear to students and colleagues, (b) in ways that can be directly assessed, and (c) in ways that can be used by external reviewers to determine the content and level of the course.

Assessment data at the course level are derived from the combination of student grades by each course with the learning objectives assigned to that course. The primary focus on data analysis at this level is on student achievement as they progress through the curriculum. Data accumulated at the curriculum level can provide important information on the interface of courses. For example, when students experience difficulty in a course, assessment data should be able to indicate whether adjustment is required in a preceding course by changing the assigned learning objectives or by changing the metrics used by ascertaining achievement of the learning objectives. Decisions to make major changes in course content or combinations of courses take place at this level.

V. The Role of External Constituencies in Assessment, Evaluation and Improvement of our Programs

Our programs are developed, reviewed, and revised based on the needs and requirements of the school's major constituencies. Our major external constituencies are our alumni and their employers. A variety of approaches are used to collect and utilize input from our graduates (alumni) and the employers of our graduates.

The School of Engineering Presidential Advisory Council (SEPAC) provides input to our programs. They represent the views of our graduates’ employers. Another venue used to incorporate the views of the employers (the engineering community) in improving our programs is through the Accreditation Board for Engineering and Technology (ABET) publications and accreditation requirements. The ABET accreditation criteria are developed through the collaboration of engineering industry and academia, hence reflecting the needs of employers of our graduates. The school and University periodically conduct surveys of our alumni. In these surveys, we attempt to determine how effectively our graduates fulfill the mission of the University and the school, obtain their opinions regarding their educational experience at the University, and solicit their advice on how to improve our offerings. These surveys provide us important data and input from our alumni, as well as the engineering community.
The purpose of conducting alumni and employer surveys in the context of our assessment and evaluation plan for excellence is threefold.

1. Determining the proper objectives for our programs and the achievement of these objectives,
2. Determining and assessing program outcomes for our engineering programs, and
3. Improving the effectiveness of our programs.

In recent years, we conducted the following external constituency surveys:

1. A University-wide survey of the graduates of 1989 and 1994. This survey was conducted by the University of Portland Office of Institutional Research,
2. 1996 and 2000 alumni surveys, and

VI. Programmatic Changes as a Consequence of Assessment and Evaluation

Program assessment and evaluation, and course assessment have resulted in positive changes in curricula, program offerings, course content, and pedagogy. Below is a sample of recent assessment-driven changes made to our programs:

1. The freshman curriculum was revised to improve retention and better prepare our students for their subsequent courses,
2. The contents of the Introduction to Engineering and associated laboratory course were modified to (a) be consistent with other changes in the engineering common curriculum, and (b) de-couple the contents of the two freshman courses,
3. The school's Instructor and Course Evaluation instrument was revised to better assess student learning,
4. One undergraduate engineering program was discontinued and three graduate programs were consolidated into one, and
5. The School of Engineering Scholarship Guidelines for faculty members were revised to emphasize those scholarship activities that are important to an excellent undergraduate engineering program.