Experiences with the Review of Engineering Doctoral Programs
At Texas A&M University

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Abstract

Institutions are assessing graduate programs as a means of strengthening graduate education. A facet of continual assessment programs, it is brought about, in part, by regional accreditation associations. Texas A&M University has had a process for the review of doctoral programs in place for several years. The University will have completed the review of the Mechanical Engineering doctoral program by the summer of 2003. This is the fourth doctoral program to have been reviewed in Texas A&M University's College of Engineering in as many years. The others are Chemical, Civil and Electrical Engineering. Civil and Electrical Engineering each have sizeable engineering doctoral programs of approximately 100 Ph.D. candidates. The review process involves external reviewers and the preparation of extensive documentation. This paper discusses the major features of the Mechanical Engineering doctoral program review. It outlines the review process and describes the required documentation. The procedures for identifying and choosing external reviewers are explained. The conduct of the on-site review is discussed and the procedures for documenting the review are described, as are the types of possible actions from the review. The similarities and differences between the doctoral review and an ABET review of an undergraduate engineering program are described. The review of the Mechanical Engineering doctoral program occurred in February 2003. Since this paper was completed before the visit, the presentation at the ASEE Annual Conference & Exposition will discuss the final phase of the review process. It will include the nature of the outcome and describe the feedback obtained by the Mechanical Engineering faculty as a result of the review.

Features of Texas A&M University and the Mechanical Engineering Graduate Program

Founded in 1876, Texas A&M University is a land-grant, space-grant, and sea-grant institution, located 100 miles north of Houston in College Station, Texas. With a fall 2002 enrollment of over 45,000 students, the University has ten colleges; engineering is the largest, having about 9,700 total students. Of these 2,000 are graduate students and 7,600 are undergraduates. Approximately 750 of the engineering graduate students are pursuing doctoral degrees.

The Dwight Look College of Engineering is one of four components of the Engineering Program. The other components are the Texas Engineering Experiment Station (TEES), a state-wide agency, through which most of the engineering research is conducted; the Texas Engineering Extension Service (TEEX), also a state-wide agency, offering non-credit technical programs; and the Texas Transportation Institute (TTI). Dr. G. Kemble Bennett serves as the Vice Chancellor and Dean of Engineering and is responsible for all four organizations. The annual research expenditures through TEES is $300 million of which $70 million is directly attributable to the Dwight Look College of Engineering.

The Dwight Look College of Engineering is composed of nine departments of engineering, a department of Computer Science, and a department of Engineering Technology & Industrial Distribution. The Department of Agricultural and Biological Engineering is in the College of Agriculture and Life Sciences, but works very closely with the College of Engineering. A total of 13 ABET accredited BS engineering programs and four ABET accredited BS engineering technology programs are offered. The three largest engineering programs, Civil, Electrical and Mechanical Engineering are all approximately the same size. The Dwight Look College of Engineering has 288 tenured/tenure track faculty, plus a number of lecturers and research professors.

The Department of Mechanical Engineering had 1048 undergraduates and 305 graduate students in the fall of 2002. Virtually all of the students were full time. Approximately 98 of the graduate students were doctoral candidates. In the fall of 2002, there were 46 tenured/tenure track Mechanical Engineering faculty, plus lecturers and research professors. The Department offers approximately 185 course sections per year, about 25% being at the graduate level. Annual research expenditures for 2001-2002 amounted to approximately $7.0 million.

Mechanical Engineering manages its enrollment by controlling entrance requirements. Undergraduates must have a 2.85 quality point average on a 4.00 system to be admitted to upper-level study as mechanical engineering majors. Graduate students are admitted based on a composite score that includes consideration of the GRE score, undergraduate performance, and for international students, performance on the Test of English as a Foreign Language (TOEFL) examination.

The Texas A&M University Doctoral Program Review Process[1]

The doctoral program review process at Texas A&M University has evolved through suggestions provided by deans, department heads, the Faculty Senate, distinguished professors, the Council of Principle Investigators, the Graduate Council, the Graduate Operations Committee, the Academic Program Council, the University Research Council, and the Graduate Student Council. The review process was tested and refined during a year-long test period. Seven key characteristics define a quality doctoral review, and provide a clear description of the importance and potential of the doctoral program review process.

1. **Internal**
   University initiates and administers the review.
2. **Evaluative**
   Academic judgements about the quality of the program and adequacy of program resources provide more than an assessment of minimum standards to subjective evaluations of quality by peers and recognized experts in the field.
3. **Forward-looking**
   Review aims to improve the program, not merely assess its current status.
4. **Academic criteria**
   Review team evaluates program on the basis of academic strengths and weaknesses as described in **Vision 2020**[2] goals**.**

5. **Objective**
Review team reviews departmental self-study document and makes evaluations using independent judgements. A well-constructed doctoral program review leads to a careful evaluation by persons with no vested interest in the outcomes.

6. **Independent**
Process remains independent from any other Texas A&M University review process, draws independent conclusions, and directs recommendations to people who have an interest in improving Texas A&M University graduate programs -- the faculty and administrators of Texas A&M University.

7. **Results in action**
Department develops a plan acting on reviewers' comments and recommendations to implement the desired changes according to a specific, agreed-upon timetable, including both Vision 2020 and the Texas A&M University Strategic Plan, with time frame and benchmarks for follow up.

Preparation of the Documentation

The department prepares a descriptive and evaluative self study. This study provides basic information about the program and includes the faculty's assessment of the program's strengths and weaknesses. A program self study is the faculty's opportunity to scrutinize itself.

The emphasis for departments and reviewers should be on the future. Departments should be encouraged to commit themselves to specific, long-range planning in the self study. The program review is forward-looking, directed toward improvement of the program, as well as assessing the current status.

Selection of the External Reviewers

An important task for the department is to develop a list of six to seven potential reviewers. We strive to select top-notch individuals for the review process. The peer reviewers are usually from academia, but can also be drawn from business or government. Nominees are usually nationally recognized in their field.

The department should initially contact potential reviewers to ascertain availability and interest before forwarding the nomination list to the provost through the Dean of Graduate Studies. The Dean of Graduate Studies will invite the reviewers as selected by the Provost. From the list of potential reviewers, the review team will be selected according to the following criteria:

- Three reviewers per team
- No more than one reviewer from a private university
- Reviewers should be independent with no significant relationship with the department or program; that is, no former doctoral or postdoctoral students or longtime collaborators at Texas A&M University

Conduct of the On-Site Review

The conduct of the on-site review has evolved from several years of experience with a wide range of doctoral programs. The external reviewers receive the department's self-study documentation and the Graduate Catalog[3] about two weeks ahead of the review. The review begins Sunday evening with the team members arriving on Sunday afternoon. The team departs Wednesday afternoon, providing three full days for the review. Since there are three external reviewers, it is quite a thorough process.

As the review team members arrive, they are met by department representatives, given a driving tour of the campus and taken to their hotel. A dinner meeting with the visiting team members and key department representatives takes place Sunday evening, allowing time for the team members to discuss their initial impressions gained from examining the self-study document.

The team members are met early Monday morning by the Dean of Graduate Studies and escorted to the Office of the Executive Vice President and Provost for a breakfast meeting. They meet next with the Vice Chancellor and Dean of Engineering for an overview of the College of Engineering before going to the Mechanical Engineering Department for a general overview of the undergraduate and graduate programs and an in-depth briefing on the graduate curriculum. A luncheon meeting between members of the visiting team is arranged with doctoral students selected from the four main areas: thermal & fluid systems, materials, mechanics & design, and systems & control. The balance of the afternoon is devoted to meetings with faculty in the four areas. A reception and dinner for the visiting team and the entire faculty occurs Monday evening at the Faculty Club. The visiting team members caucus afterwards at the hotel.

Assistant professors represent the future of the department, so they have a breakfast meeting with the visiting team members Tuesday morning. The morning is devoted to tours and briefings about the Turbomachinery Research Laboratory, the graduate computing laboratory, and a few Mechanical Engineering faculty research laboratories. A lunch with technicians and selected staff members gives the visiting team a view of the department's infrastructure. The afternoon includes a meeting with the department's Promotion and Tenure Committee, tours of additional research laboratories, and a meeting with the Department's Graduate Studies and Research Committee.

Late Tuesday afternoon and evening, the visiting team members discuss their findings and prepared their briefings.

The visiting team presents its exit interview to the Provost and the Vice Chancellor & Dean of Engineering at a breakfast meeting. Afterwards the visiting team presents and discusses its findings and recommendations at a meeting of the Mechanical Engineering faculty, staff, and student representatives.

The team departs Wednesday afternoon.

The Self-Study Documentation

The specifications for the self-study document are quite broad because the process must be

adaptable to the wide range of doctoral programs offered at the University, approximately 65 of them. Consequently, the departments being reviewed are afforded considerable latitude to prepare a self-study document which will provide in-depth information to describe their doctoral program. The instructions bear little resemblance to those for pre-EC2000 ABET self-study volumes. However, engineering faculty are more comfortable with the ABET model, so the preparation of the Mechanical Engineering self-study document was influenced by ABET experience and the accreditation of undergraduate programs.

Dr. N. K. Anand, the department's Director of Graduate Programs, supervised the preparation of the self-study document. Two engineering departments, Civil Engineering and Electrical Engineering, had reviews of their doctoral programs in the two years preceding the Mechanical Engineering review. Counterparts in those two departments were very helpful to Dr. Anand. A considerable body of data had to be gathered, syllabi in a standardized form were prepared for all graduate courses, and two-page faculty résumés in the ABET-format were prepared.

The sections of the self-study report included:

1. Mechanical Engineering Department
   - 1.1 History
   - 1.2 Administrative Organization
   - 1.3 The Faculty
   - 1.4 The Student Body
   - 1.5 Academic Laboratories & Computing Facilities
   - 1.6 Operational Efficiencies
   - 1.7 The Advisory Council and Its Role
2. Graduate Programs
   - 2.1 Office of Graduate Studies
   - 2.2 Graduate Degrees
   - 2.3 Graduate Admissions
   - 2.4 Financial Support
   - 2.5 Graduate Student Enrollment
   - 2.6 Digital Archiving System
   - 2.7 Graduation Statistics
   - 2.8 Exit Interviews
   - 2.9 Rankings
3. Degree Requirements
   - 3.1 Masters Degree Requirements
   - 3.2 Doctoral Degree Requirements
   - 3.3 Doctoral Examinations
   - 3.4 Graduate Course Offerings
4. Mechanical Engineering Research
   - 4.1 Research
   - 4.2 Research Groups
     - Applied & Computational Mechanics & Design
     - Ceramics & Metals
     - Combustion & Fuels
     - Energy Systems
     - Fluid Mechanics
     - Heat Transfer
     - Polymer Technology
     - Systems & Controls
     - Turbomachinery
5. The Future of the Department

Appendices
- A. Faculty Biographies
- B. Graduate Course Syllabi
- C. ME Development & Advisory Council
- D. Research Contracts, Grants, & Gifts
- E. Sample Degree Plans

The self-study document includes copious amounts of data regarding production of M.S. and Ph.D. degrees, examples of placement of Ph.D.'s, student credit hour generation, teaching loads, frequencies of course offerings, and general budgetary considerations.

Faculty members were extensively involved in the preparation of the self-study document. They were asked to provide significant data, prepare course syllabi and their individual résumés, and they were asked to critique sections of the self-study document. As these sections were prepared, they were posted on the Department's Intranet for examination and comment by members of the faculty.

Selection of the External Reviewers

The value of the doctoral program review depends strongly on the skill and hard work of the external reviewers. The faculty members were asked to nominate potential external reviewers and to provide basic information about their candidates. Only people with no prior affiliation with Texas A&M University could be considered.

The Provost requested six nominees for the three positions. Each nominee was contacted to ensure their willingness to serve if selected by the Provost. A modest honorarium is provided the reviewers for their dedicated work. The Mechanical Engineering Department was very fortunate to have three highly qualified persons who agreed to serve as visitors.

Status on January 15, 2003 (the deadline for this paper)

The review was scheduled for February 9-12, 2003. The deadline for this paper was January 15, 2003. The preparations were virtually complete. The last edits of the self-study document had just been finished. The visit schedule had been established and travel arrangements for the visitors had been made. The whole Department was poised for the visit and the external review.

Benefits Received from the Preparation of the Review

As is true of ABET accreditation visits, great value accrues from the preparation of the self-study document. Adjustments in the doctoral program have been made or planned from information the faculty members have learned in the process of collecting the information and organizing it in good form for the evaluation by external peers. Course offerings have been reviewed carefully and some courses now found to be less applicable to the current directions of mechanical engineering have been dropped. New synergistic relationships have spring up as faculty members learned more about each others talents and interests.

Reporting the Results of the External Review

The preparation of the self-study documentation, the schedule for the external review, and the selection of the external reviewers has been prepared for the Proceedings. The presentation at the ASEE Annual Conference & Exposition will contain accounts of the visit experience and present the findings of the external reviewers and the response of the Mechanical Engineering Department.

Status of the Review on March 25, 2003

The Doctoral Program Review Committee's report was sent to the Mechanical Engineering

Department by the Office of Graduate Studies on March 6th. The report is thorough and fair; it presents an analysis of strengths and recommends areas that should be strengthened if the objectives in Vision 2020 are to be achieved. The Department is preparing its response, so it is premature to provide further details until the process has run its course. That will have taken place prior to the ASEE Annual Conference when further information will be provided.

Appendix: Texas A&M University's Vision 2020 Task Force Report

On October 10, 1997, then President Ray M. Bowen (a Fellow Member of ASEE) commissioned a task force to propose the steps Texas A&M University must take to become one of the ten best public universities in the nation by the year 2020. The task force involved over 250 people, with representatives from industry and academe. The task force was charged to determine which institutions are best; assess where Texas A&M University is strong and what needs the most work; examine Texas A&M University's core values; and sharpen Texas A&M University's mission and vision statements. The task force reported on May 28, 1999.

Vision 2020 enumerates 12 imperatives, to which the current President, Dr. Robert Gates, has added a 13th. The imperatives are:

1. Elevate Our Faculty and Their Teaching, Research, and Scholarship
2. Strengthen Our Graduate Programs
3. Enhance the Undergraduate Experience
4. Build the Letters, Arts, and Sciences Core
5. Build on the Tradition of Professional Education
6. Diversify and Globalize the A&M Community
7. Increase Access to Knowledge Resources
8. Enrich Our Campus
9. Build Community and Metropolitan Connections
10. Demand Enlightened Governance and Leadership
11. Attain Resource Parity with the Best Public Universities
12. Meet Our Commitment to Texas
13. Space.

For the next few years, President Gates has chosen to focus on items 1, 2, 3, 6, and 13. Information about Vision 2020 is available at the web site http://www.tamu.edu/vision2020.

References

1. *Doctoral Program Review Guidelines*, *Fall 2001*, Office of the Vice President for Research/Office of the Dean of Graduate Studies, Texas A&M University. Available at http://vpr.tamu.edu/ogs/dpr.html.

2. *Vision 2020, A Plan for the Future of Texas A&M University*, sponsored by the Office of the President, Texas A&M University, 2000. See also http://www.tamu.edu/vision2020.

3. *Texas A&M University Graduate Catalog, 125th Edition,* Texas A&M University. See also http://www.tamu.edu/admissions/gcat/.