

Initial Attempt at Outcomes Assessment in Nuclear Engineering

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Abstract

In 1995 the UW-Madison campus required that all majors develop educational objectives and implement outcomes assessment procedures. In Nuclear Engineering and Engineering Physics we chose to focus on exit interviews of graduating students and written questionnaires mailed to alumni who graduated three years earlier. The assessment process began in the spring 1995 semester. Lessons learned from this initial attempt at assessment are reported.

I. Introduction

The UW-Madison campus has required that educational objectives and outcome assessment procedures be developed and implemented for all majors. This arose because of a requirement from the North Central Accrediting Association, which accredits the campus. A similar requirement for engineering has emerged from ABET as part of the ABET 2000 criteria being implemented. In order to meet this requirement in the Department of Nuclear Engineering and Engineering Physics, a committee was formed to formulate educational objectives and propose an assessment plan for each of our degree programs at the undergraduate and graduate levels. The educational objectives and assessment plan were adopted by the department in the Spring 1995 semester. The assessment plan was implemented partially that semester and more fully the following academic year. In this paper we report on our experience with this initial attempt at outcomes assessment for our undergraduate nuclear engineering major.

II. Educational Objectives

The educational objectives adopted divide into general goals, knowledge goals, and skill goals. These are given below.

General Goal

The goal of the program is to provide to students: the knowledge and skills necessary for immediate and life-long employment in nuclear engineering; a sufficiently fundamental education to enable students to pursue post-graduate education in nuclear engineering and related fields, and to adapt to emerging technologies throughout their career; and a broad perspective of the ethical responsibilities and societal impact of their profession.

Knowledge Goal

To provide a fundamental education in all of the areas of: mathematics, physics, computer science, basic engineering science, nuclear engineering design, and humanities including ethical, societal and diversity issues. This will include in-depth exposure to most of the areas of: radiation shielding, reactor physics and design of core loading patterns to achieve safe and efficient use of nuclear fuel, nuclear engineering design including lessons learned from the first generation of commercial reactors and advanced reactor designs, economic and environmental issues associated with nuclear energy and reactor/balance-of-plant design.

Skill Goal

To develop and nurture skills in visualization, problem solving using analytical and computational techniques, laboratory techniques, oral and written communication, and group cooperation.

III. Assessment Measures

The department adopted assessment measures based on the Fundamentals of Engineering examination, exit interviews of graduating seniors, and surveys of alumni.

1. Require all graduating seniors to take the Fundamentals of Engineering (F. E.) examination. Their performance will be tracked and areas of weakness noted. This requirement was conditional on the university paying the examination fee for the students.
2. Conduct exit interviews with graduating seniors to determine their satisfaction with the program, problems they have encountered, suggestions for improvement, and plans for employment or further study.
3. Survey alumni three years after graduation to determine their satisfaction with the program, possible weaknesses in their education that became apparent after graduation, suggestions for improvement, the path their career has taken since graduation, and future career plans.

IV. Implementation and Results

The College of Engineering obtained funding from the campus administration to assist two departments each year in further developing and implementing their assessment plans. The Nuclear Engineering and Chemical Engineering departments were chosen for this funding for the first year; both of these departments had adopted surveys as a substantial part of their assessment tools. The funding was used primarily to hire the assistance of the LEAD (Learning through Evaluation, Adaptation, and Dissemination) Center to work with these two departments.

Fundamentals of Engineering Exam

Further consideration of using the F.E. exam as an assessment tool led us to question its usefulness at this time. We heard reports that the exam is being revised at the national level to improve its usefulness for assessment. We also heard reports that at some schools where students

are required to take the F.E. exam but not to pass it, some students showed up for the exam, signed their name to certify that they "took" the exam, but turned in blank exam papers, thereby automatically failing it. This defeats the purpose of using it as an assessment tool. The problem is in requiring the students to take the exam when they don't see it as important to their careers. Consequently, we delayed implementing the F.E. exam as an assessment tool.

Exit Interviews of Graduating Seniors

Exit interviews of graduating students began in the spring 1995 semester. Initially, they were done by the department chair. The process consisted of a one-on-one interview with each student using a standard set of questions with the interviewer taking notes during the interview. Most interviews lasted about a half hour. The questions focused on:

1. Plans after graduation: For those choosing to seek employment, current status of the job search, job offers received. For those going on to graduate school, choice of graduate school and field of specialization.
2. Long-range career goals and general feelings about having chosen nuclear engineering as a major.
3. Specifics about the nuclear engineering curriculum: courses they liked or didn't like; courses they found too easy, too difficult or too time consuming; courses they would like to have taken but didn't and why; curriculum changes they would suggest and features they would preserve.
4. Feeling about the department: strengths, weaknesses, frustrations experienced, suggestions for improvement.

The response was that most students were pleased to be asked for their opinions. When the word got around that we were conducting the interviews, some students came in prior to being contacted to set up an appointment. Only a few students did not show up or could not be scheduled for the interviews. Most comments were positive, although negative comments about certain courses and the frustrations in finding nuclear engineering jobs were received.

A concern with having the department chair conduct the interviews is that students may view the department chair as an authority figure and not a neutral observer concerning the strengths and weaknesses of the department. Consequently, not all students may express their true feelings in such an interview. In the spring 1996 semester, the interviews were conducted by the personnel of the LEAD center. They modified the process so that students filled out a short questionnaire on factual data just prior to the interviews, which were taped and later transcribed. The transcriptions were then analyzed for recurring themes; this formed the basis for a report submitted to the department.

Our impression was that more was learned from the LEAD interviews than from interviews conducted by the department chair. This could be because the LEAD interviewer was trained in interview techniques, whereas most department chairs are not. This could also be because the department chair is not seen by students as a disinterested observer, which can cause students to be more reticent in expressing concerns. The expense of hiring a professional to conduct the

interviews each year is prohibitive, so we are considering an alternative of using focus groups led by College of Engineering personnel.

Regardless of how the exit interviews are done, we believe there is merit in doing them. The data obtained is useful feedback to the department. Some professors will argue that nothing new is learned if you are in touch with your students. While this may be true, there is real benefit in carrying out the interviews systematically; the results carry more weight with the department and with the administration. The students also receive the message that their opinions are important and they appreciate being listened to.

Surveys of Alumni

There are at least two approaches to surveying alumni. One approach is to survey all alumni occasionally. This has the advantage of generating a larger statistical sample, but mixes recent graduates with earlier graduates. Another approach is to survey only those alumni who graduated n years earlier and to do this every year. This leads to a very small sample for any given year. We currently graduate about 10 students per year, so a return of 50% (considered very good by professionals) yields only five responses per year. A statistically significant sample is obtained only after collecting responses for several years.

We chose to survey every year the alumni who graduated three years earlier ($n = 3$). The survey questionnaire was developed by the LEAD center and sent to graduates from four years earlier as a pilot. The survey form was revised after getting feedback from these respondents and then sent to graduates from three years prior. The response rate has been disappointing; out of 29 graduates in these two years, we received four responses. Our analysis of this suggested the following reasons:

1. The questionnaire was too long. There is a tendency of the faculty to add questions because everyone has their own favorite issue. Long questionnaires lead to reduced return rates so it is important to restrict the questionnaire to essential questions only.
2. In hindsight, it was clear that the questionnaire was oriented towards graduates working in the nuclear industry. Only a minority of graduates fit this model. Many of the graduates from three or four years prior were still in graduate school so the questionnaire did not appear relevant to them. Some other graduates had since left the nuclear industry so the questionnaire also seemed irrelevant to their current situation. The questionnaire needs to recognize that alumni follow a variety of career paths and be designed accordingly.
3. More follow up effort was needed to encourage a response by those who did not initially return the questionnaire.
4. We did not have current addresses of some of the graduates and were unable to locate them. More effort was needed in keeping the alumni database current.

V. Summary

The use of the Fundamentals of Engineering exam as an assessment tool requires further study. The exit interviews of graduating students was successful and yielded significant results. The survey of alumni has not yet led to a significant number of responses. We are continuing with the exit interviews of graduating students and surveys of alumni. The LEAD center is working with two other departments on implementing their assessment plans; this will provide additional information to use in further refining our processes.

Acknowledgments

We gratefully acknowledge the assistance of Kathleen Luker in the office of the Dean of Engineering and the personnel of the LEAD Center, especially Dianne Bowcock and Lynn Squire.

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