A Senior Seminar Course for Engineering Technology Outcomes Assessment

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Abstract

Traditionally, a capstone course includes projects where students work in teams on a given problem. Results are reported to the course instructor when the project assignments are completed at the end of the semester. This paper introduces a senior seminar course that provides students and faculty with a means of measurement for evaluation of students' technical presentation, written, oral, and graphical communication skills throughout the course. Furthermore, this course provides engineering technology programs with quantitative and qualitative measures that may be incorporated as one component of a plan for assessment of student academic achievement.

1. Introduction

Accountability has become a national concern in higher education. In response, accrediting agencies require the development and implementation of academic assessment models designed to assure and enhance institutional improvement. As part of the accreditation review process, each baccalaureate and graduate program is required to prepare and implement a plan for assessment of student academic achievement. The assessment plan is to contain the following: a department goal statement related to the university's mission, intended outcomes/objectives, assessment criteria and procedures, and implementation strategies. This article, while revealing aspects of academic outcomes assessment, focuses primarily on criteria and procedures for the development of a senior seminar course that serves as part of the requirements for assessment of student achievement in the engineering technology curriculum.

Departments are encouraged to use multiple measures for each identified performance objective and to blend quantitative and qualitative measures. These may include nationally normed and standardized objective measures, locally developed objective and essay exams, exit interviews, oral exams, portfolios, senior projects, capstone courses, student satisfaction surveys, employer questionnaires, and alumni surveys. The assessment of academic achievement involves many different units within the university community but must be consistent in purpose and design. It reflects the freedom of academic departments to conduct assessment in a manner which is most appropriate for their specific program. It also reflects a high-degree of interdepartmental

cooperation and communication.

According to the new criteria for accrediting engineering technology programs for 2001-2002 accreditation cycle by TAC/ABET, the importance of outcomes assessment and written/oral technical reports is emphasized as follows:

> Criterion 1. Program Characteristics, Communications. The ability to plan, organize, and prepare effective written and oral technical reports is required. Graduates must possess the interpersonal skills required to work effectively in teams. Graduates must be familiar with the literature of their technology discipline and are encouraged to use it as a principle means of staying abreast of continual changes in their field. Competence in this curricular area is normally achieved by a combination of instruction in communications topics and incorporating communications exercises into the technical content of the program.
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> Criterion 6. Assessment. Programs must have written goals that, as a minimum, focus on the student body served, employer expectations, resource allocation, and other factors affecting the program. Programs are required to have plans for continuous improvement and evidence that the results are applied to further development and improvement of the program.
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> Each program is required to demonstrate achievements through various methods including student outcomes assessment and employer feedback. Typical evidence may consist of student portfolios including project work and activity based learning; results of integrated curricula experiences; nationally-normed subject content examinations; recent graduate surveys that demonstrate graduate satisfaction with employment including career development activities, mobility operations, and appropriate job titles; and employer surveys that demonstrate satisfaction with recent graduates. Programs also must demonstrate that their graduates are readily accepted into the workforce and are prepared for continuing education.

This paper discusses a collaborative model for a senior seminar course which is an important step for small departments in developing an innovative interdisciplinary curriculum for the assessment of student academic achievement. This cooperative effort of engineering technology programs provides students the opportunity to develop computer related projects for both software and hardware applications.

2. Course Objective

Written, oral, and presentation skills are critical in all professional fields, including engineering technology. An integral part of most technically-based jobs involves communicating with vendors, customers, managers, technicians, and engineers[1]. Ludlow and Schultz (1994) state that the ability to communicate clearly and concisely, both orally and in writing, is an important skill that all technical employees need to master to become truly successful in their professional

careers[2].

Throughout their undergraduate curriculum, engineering technology students will write essays, laboratory reports, and technical reports for class projects. Some of these class projects may also require presentations along with the written materials. The senior seminar course generally addresses job importance and student preparedness in written and oral communication skills. The course is designed to provide students and faculty with a means for assessment of technical competence of students as well as written, oral, and presentation communication skills that are critically important for success in their professional careers.

A major component of this course requires learners to plan, develop, and present a semester-long project in their field of engineering technology on a subject of their choice which demonstrates knowledge and skills in project handling, technical writing, problem-solving and evaluation processes, and oral presentation techniques. The course enables students to: (1) complete a semester project based on their field of interest, (2) prepare an effective written technical report, (3) plan and produce presentation materials which most effectively communicate the intended message for their technical oral presentation, and (4) apply concepts and practices of their field of experience to develop and effectively present their semester project to colleagues and faculty.

In addition to the semester projects, reports and presentations, the course provides a blend of assessment techniques and procedures for both qualitative and quantitative measurement and evaluation[3]. Students are required to complete a locally developed, discipline specific, essay examination near the end of the semester. While the exam provides valuable *quantitative* assessment data concerning content knowledge and discipline competence of students, it is not used for course evaluation purposes. Rather, it is intended as an assessment of student academic achievement in engineering technology programs. *Qualitative* assessment techniques provide faculty and students with information about their teaching and learning endeavors. Department faculty and students designed an exit interview instrument which is intended to determine: (1) student perceptions concerning program strengths and weaknesses, (2) data relating to university and department services, processes, and other academic issues, (3) students' future education and/or employment plans and goals, and (4) demographic information to be used in follow-up surveys.

3. Evaluation Criteria

Instructional methods include class discussion, student selected semester projects, written technical reports, and oral presentations of student work. Evaluation is accomplished in three primary stages. In the first stage, students are required to select a project topic of choice in a technical area related to their respective course of study. Creativity and imaginative thought in selecting a topic of interest are encouraged and expected in this stage. After selecting a project topic, students must plan, design and produce a formal written proposal, three to four pages in length, that describes the project and includes the following components:

1. Title page
    * Course identification
    * Department identification
    * University affiliation
    * Project title
    * Presented to:
    * Presented by:
    *Date

2. Methodology
    * Narrative description of the project
    * Identification of concepts and terminology
    * Research/background information relating to the project
    * Sketches, photographs, drawings
    * Detailed description of the project

3. Summary
    * Why the topic was selected
    * Explanation of student interest and relationship to the project
    * Description of educational value and application to this class
    * Relevance of the project

4. References
    A. Minimum of three references from which information was obtained
    * Professional journals
    * Technical magazines
    * Books
    B. Supporting materials, additional information
    * Brochures
    * Technical manuals

Students are encouraged to consult with instructors when they have questions related to the development of their projects. The written proposal is evaluated in terms of idea development, relevance for engineering technology, organization (time line, procedures, data, etc.), and initial research/background information. The proposal becomes a contract for the completion of the project as submitted by the student and approved by the instructors.

In the second and final stages of evaluation, students must complete written reports that fully describe the project as it developed and reached completion. Reports are evaluated differently in the last two stages to stay in harmony with appropriate stage. However, the reports include information from the initial proposal, progress or status of the project, time line for completion, and cost estimate or analysis. Pre-determined length for reports are not provided to students but must be organized according to the following format:

1. Title Page
    * Same format as the proposal

2. Objectives
    * Statements of what is to be accomplished in the project
    * Criteria for evaluating the success of the project

3. Introduction
    * Central problem/focus for the project clearly stated
    * Project importance to the major field of study

4. Materials/equipment
    * Description of all materials/components used in the project
    * Identification and description of equipment and facilities

5. Experimental procedure
    * Essential details of processes and procedures must be provided
    * Evidence of planning and organization must be provided

6. Data
    * Recorded data (tables, charts, graphs, figures, appendix, etc.)

7. Calculations
    * Required computations and necessary equations
    * Diagrams and schematics

8. Discussion
    * Presented theory regarding the project
    * Data and results discussed
    * Variability of results from the theory discussed
    * Any source of error described

9. Conclusions
    * Description of what the project has shown
    * General conclusions drawn which can be supported by the data collected
    * Conclusions supported and justified by the facts presented

10. References
    * Reference any material, definitions, explanations, or ideas obtained from other sources
    * References from initial research and any additional references obtained during the completion of the project

All of the reports must be clear, brief and concise, and must be word-processed or type written. Students are expected to work on their projects on a weekly basis, outside of class, both individually and in consultation with instructors.

In addition to the written reports at the proposal, mid-point progress, and project completion stages, students are required to orally present (15-20 minutes) the information contained in the reports to their colleagues and instructors at each stage. Students are evaluated on presentation materials and communication techniques from the following criteria:

1. Appearance (5 points)
   * Attire

2. Narrative (10 points)
   * Composure/attitude
   * Eye contact
   * Voice control
   * Distracting mannerisms

3. Visual aids (8 points)
   * Relevant/ effective
   * Quality
   * Significant points

4. Organization (10 points)
   * Introduction
   * Logical flow
   * Appropriate level/technology
   * Summary and conclusions

5. Technical Content (17 points)
   * Knowledge of subject
   * Coverage of subject (appropriate detail and complexity)
   * Reception and responses to questions

The Engineering Technology Program uses this evaluation criteria for presentations not only to rate students, but to provide examples of what should be avoided in presentations, and examples of what constitutes a professional oral presentation. Descriptive phrases in each category range from "unacceptable" to "excellent." The graduation from unacceptable to excellent simply allows the evaluator to assess the quality of the presentation in a general overall manner in each category. Students are encouraged to display professionalism and effort in their presentations since they will be required to give many presentations throughout their careers. Most often, the purpose of those future presentations will be to request people, equipment, and/or funding. Simply stated, the ability to deliver successful presentations is of critical importance in their professional careers.

4. Conclusion

In summary, now more than ever there is a demand for student outcome assessment plans that effectively measure student academic achievement. In small institutions with tight budgets, not every department can accomplish a new mandate independently. Collaboration among the departments is the key to success. Offering a senior seminar course for engineering technology programs provides students in each major with the opportunity to develop and discuss project topics related to different aspects of computer hardware and software, and provides a means for student academic achievement.

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