EMPOWERMENT OF COURSE COMMITTEES IN ENGINEERING EDUCATION

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Abstract *¾ This paper describes ongoing efforts to institutionalize course committees that are charged with overseeing the administration of undergraduate courses in a college of engineering in a mid-size university. Course committees were formed to address the need for formal collaboration among faculty to support educational processes, especially outcomes assessment and curriculum renewal. A critical component of the model is the empowerment of committees to maintain the learning objectives and to verify the instruction for each departmental course. The committees are also charged with maintaining and revising the assessment instruments and performance targets. Instruments developed to formalize and institutionalize the process are also described.*

Index Terms ¾ Faculty collaboration, course committees, outcomes assessment, curriculum revision.

INTRODUCTION

The value of teams and teamwork has been recognized widely and implemented successfully in business and industry. Some examples of teamwork in academia include team-teaching courses, jointly submitting research proposals, co-authoring manuscripts and co-developing laboratories. These modes of collaboration are geared towards the two basic components of a faculty member's job – teaching and research. With the increasing emphasis on outcomes assessment in engineering education, the need for faculty to work collaboratively on academic planning and evaluation issues has become very important.

Although faculty recognize the need for teamwork in outcomes assessment and curricular revision processes, the frequency and quality of faculty interaction with colleagues is hampered by the culture of academics. According to Tener [1], "the greatest challenge to developing an effective outcomes assessment system is the institutional culture of the faculty." Ewell [2] concluded that implementation of an assessment plan in which faculty provide and respond to feedback is a difficult task. Shaeiwitz [3] states the challenge as follows: "Implementation of an assessment plan in which faculty provide and respond to feedback will be a difficult task. At most institutions, it will require a significant paradigm shift in faculty behavior. It is unclear how to effect such changes; there are conflicting opinions on whether faculty is motivated by intrinsic or extrinsic factors. But, if this problem is not dealt with forthrightly at the outset, implementation of an effective assessment plan is doomed."

We believe that academic faculty are most often intrinsically motivated and have limited positive extrinsic motivation possibilities. Several studies support this belief (see for example, Sloan [4], McKeachie [5], Csikszentmihalyi [6], Deci and Ryan [7]). In other words, the use of financial or recognition rewards are not as likely to aid the development of any meaningful collaboration involving faculty as are intrinsic rewards such as the prospect of student learning improvement, intellectual stimulation, satisfying relationships with students and colleagues, and a sense of autonomy. Prompted by this, the college of engineering at North Carolina A&T State University embarked on an effort to create course committees with the goal of promoting a collaborative decision making structure without challenging the academic freedom of the individual instructor. This paper describes our experience with course committees and offers a model for implementing them in an academic department. The authors of this paper represent key faculty and administrators involved in conceiving and implementing course committees on our campus. The discussion also includes the process used to institutionalize course committees in the academic departments as well as an example of a course committee report. The discussion also includes examples of course and curriculum changes that have resulted from the activities of these committees.

COURSE AND CURRICULUM DECISION MAKING BEFORE ADOPTION OF COURSE COMMITTEES

Three years ago, the undergraduate program administration was focused on maintaining status quo as far as possible. Course instructors had latitude in defining course content, delivery style and student evaluation. The set of courses required for the degree was fairly static. When changes did occur, they were often ad hoc and driven by administrative and resource considerations, or by external constituents such as employers of graduates. This approach led to various problems some of which are listed below:

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- Instructors had no clear direction to promote consistency in the curriculum between courses and between offerings of the same course.
- Instructors had little guidance on how to evaluate course effectiveness;
- Programs administrators had little basis for evaluating instructors and little means for promoting overall program strategy through classroom teaching;
- Students taking different offerings of the same course learned significantly different content and may have used significantly different learning resources (books and software).
- The inter-connection between related courses was often disjoint and not apparent to students;
- Although instructors were concerned about improving their own courses, there was little opportunity for any broad program level improvement through integration among courses;
- The uniqueness and mission of the institution was largely ignored in the curriculum planning and teaching process; and
- Several skill and knowledge areas were either not taught in any course or redundantly taught in many courses.

Some of these problems could be remedied by a higher level of administrative control. However, this is generally unpalatable in an academic environment that stresses shared governance and has a long-standing tradition of academic freedom. Course committees were instituted to provide (i) a balance between the needs for consistency in the program and the academic freedom in teaching, and (ii) to build a program around broad departmental strategy while allowing bottoms-up design of the academic program.

STRUCTURE OF COURSE COMMITTEES

Course committees are generally comprised of a subset of department faculty members who either teach the particular course or have expertise in that or a related subject. The assignment of faculty members to course committees is done collaboratively by all department faculty and is based on teaching and research interests. The committee chair may be someone who does not always teach the course and is responsible for (i) scheduling at least one course committee meeting during each semester, (ii) ensuring that course materials are available for the committee when it meets, and (iii) submitting the annual course report to all faculty in the department. Membership is fairly static to encourage strategic thinking.

The course committees are charged with making annual recommendations to the entire department on content additions and deletions, instructional practices, textbook options, and assessment instruments for each course. The committees are expected to promote the institutionalization of knowledge sharing, thereby increasing collegial interaction, and to help distribute administrative power and academic ownership to the entire department. The course committees have the following goals:

- Leading curriculum change so as to actually realize improvements in student learning in a reasonable time frame;
- Involving faculty at each step in the curriculum revision process and enabling non-administrative faculty champions to have a key role in this process;
- Making the process sustainable and reliable by carefully controlling the amount of data collected and providing summarized results to faculty in a timely manner; and
- Empowering faculty to manage course and curriculum related decisions.

The key responsibilities of each course committee are listed below:

- To specify the minimal course learning objectives;
- To specify assessment instruments for the course;
- To specify performance targets for assessing the course learning objectives;
- To determine if the course syllabus was covered;
- To evaluate whether course learning objectives have been achieved;
- To select the course text(s), laboratory experiments and software packages; and
- To annually review the course and recommend changes and improvements through an annual course report.

TRANSITION OF ACADEMIC AUTHORITY FROM INSTRUCTOR TO COURSE COMMITTEE

The first set of course committees was formed in fall 1999 and more have been created since then. The faculty adopted the following phase-in plan for transfer of academic authority from individual course instructors to course committees in the chemical engineering department. The first time each course is taught, the instructor will determine all topics to be included in the syllabus, the course textbook, all learning objectives for the course, and all questions for the course assessment test. However, instructors are encouraged to consult with the course committee about course topics. The second time the course is offered, the faculty member must consult with the course committee with regard to these decisions. The third and each subsequent time the course is offered, the course committee assumes full authority over these decisions.

PROCESS EMPLOYED BY COURSE COMMITTEES

At the beginning of each semester, course committees for all undergraduate courses taught in the previous semester meet. The process is initiated by the undergraduate program coordinator who supplies course committee leaders with the following information:

- Description of the course committee process;
- Previous course committee reports, if any;

- Syllabus from the previous semester; and
- Student evaluation feedback concerning course learning objectives.

The committee leader organizes the committee meeting with the following agenda:

- Review course name, description, prerequisites, textbook, software, and lecture/lab content;
- Review program outcomes associated with course;
- Review course syllabus and revise as needed; and
- Review course learning objectives and students' evaluation of extent to which they were achieved in past offerings of the course. Care is taken to ensure that course learning objectives are consistent with overall objectives of the program, and are stated using Bloom's taxonomy. Generally, higher-level courses are associated with higher levels in Bloom's taxonomy.

The committee generates a report of their discussions and submits suggested course changes to the department-level undergraduate program committee (an example course committee report is attached in Appendix A). The undergraduate program committee reviews all the course committee reports, summarizes the findings and gives feedback to the course committee chairs. Issues regarding course textbook, software, and learning objectives (general and detailed) are at the discretion of the course committee with no further action. Issues regarding course name, catalog description, prerequisites, and lecture/lab content require a curriculum change, but typically are accepted by faculty vote unless faculty determines they are inappropriate based on information not available to the committee. Any program outcome change is accepted unless it leaves an objective inadequately covered in the curriculum or causes the course to loose focus.

FINDINGS AND CHANGES RESULTING FROM COURSE COMMITTEES

The nature and dynamics of course committees is still evolving. Yet, their impact has been substantial. Due to committee suggestions, improvements in course names, descriptions, prerequisites, and sequencing have been instituted. More importantly, a higher level of faculty communication regarding curriculum is taking place, resulting in more coordination between courses. Committees have collaborated to eliminate redundancy of topics among courses and to shift course content where appropriate. Faculty members are becoming increasingly comfortable with teaching by objectives, significantly improving the consistency and quality of the educational experience. The increased communication about course content, teaching methods, and assessment methods has been beneficial in terms of providing ideas for teaching improvements and identifying program weaknesses. Most importantly, better and more sustainable curriculum decisions are being made because of the wider faculty input into curriculum decisions. Finally, the course committee structure has promoted greater interaction among faculty on a broader range of educational and research activities.

Every course committee made and implemented at least one course change recommendation that was later approved unanimously by the full department faculty for implementation. The following list highlights some of the findings and recommendations of the course committees:

- Course learning objectives were modified for most courses;
- The textbooks (or other reading materials) was changed in several courses;
- Problem solving tutorial sessions were requested and provided in some courses;
- It was discovered that instructors strayed from the prescribed course syllabus in several cases. This was corrected by action of the course committees;
- It was concluded that topics assessed in the senior comprehensive exam should be better correlated with the course learning objectives in core required courses;
- Faculty agreed to include homework problems in safety in most chemical engineering courses;
- A new course in process data analysis and experimental design has been adopted;
- Faculty agreed on a plan for using the ASPENPLUS chemical process simulator across the program;
- The programming language in freshman computing was changed from FORTRAN to MATLAB and Visual Basic; and
- Several additional hands-on exercises were added to some laboratory courses that reinforced key concepts taught in co requisite lecture classes.

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SUMMARY

This paper provides a brief description of ongoing efforts to establish course committees for managing course and curriculum revision based on outcomes assessment. Our experience over the last three years indicates that the course committee structure has resulted in an environment that promotes collegiality and offers a collaborative mechanism for an integrated approach to curriculum improvement without threatening academic freedom. The college plans to implement this approach to all courses including those taught by supporting departments outside the engineering college.

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APPENDIX A

Course Committee Report: INEN 346 Fall 2001

Course Committee Members

Paul Stanfield (Committee Chair), Silvanus Udoka, Eui Park

Course Instructor

Fall 2001 Instructor – Dr. Silvanus Udoka

Meeting Date

February 15, 2002

Material reviewed

- Course syllabus
- Course learning objectives
- Course program outcomes
- Course learning objective feedback

Findings and Recommendations

- Prerequisites should be changed to INEN246 only. Prerequisites of INEN365 and INEN415 were discussed, but not selected due to curriculum sequencing.
- Some integrating aspects of the old course INEN432 course must be achieved in new INEN485 course.
- Associated program outcomes should be:
  - Apply knowledge of industrial engineering theory
  - Summarize and interpret data
  - Design or improve integrated systems of people, material, information, equipment and energy
  - Utilize tools of information technology
  - Ability to work in teams
- Considered adding program outcome of Ethics, but chose not to.
- Course objective student feedback indicated no specific areas requiring significant improvement. The committee decided to rewrite the objectives to make them more specific and useful for course improvement.
- Course objectives in subsequent semesters should be modified to better fit with associated program outcomes. Course objectives state that upon completion of the course, the student will be able to:
  - Estimate manufacturing system performance given the performance of system components.
  - Analyze manufacturing system information to identify improvement opportunities and prioritize opportunities based on economic justification.
  - Describe the components and justification of the following manufacturing strategies: design for manufacturing/assembly, just-in time manufacturing, group technology, and flexible manufacturing systems.
  - Construct simple manufacturing control programs for programmable controller, industrial robot, and vision system.
  - Develop functional specifications for automation system components including machines, controllers, robots, vision systems, inspection systems, assembly systems, and sensor/actuators.
  - Plan an automation project and manage an automation project team.