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Faculty Collaboration and Course Coordination with Feeder Campuses using Information Technologies

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ABSTRACT

With a growing emphasis on vertical and horizontal integration of engineering curriculum there is a growing need for strong coordination among the engineering courses. This coordination is necessary for accreditation specially in courses that satisfy design requirements. Four-year engineering institutions that receive a significant percentage of their graduates transferring from two-year institutions or community colleges have the enormous task of coordinating their curriculum across institutional boundaries.

This paper outlines a coordination and collaboration model that has been developed and implemented at the Pennsylvania State University. The model has been implemented on a first-year design course taught at 19 campuses in the Penn State system. The model involves developing a new course structure, identifying coordination team, identifying coordination mechanisms using appropriate technology, faculty development, and incentives to sustain long-term coordination.

A COURSE STRUCTURE FOR COORDINATION

Several of the colleges in the NSF sponsored Engineering Education Coalition have efforts underway to redesign the first-year engineering course as a design course[1,2]. This is also one of the missions of the ECSEL (Engineering Coalition of Schools for Excellence in Education and Leadership), where Penn State plays a leading role in developing a model for course coordination among multiple campuses.

The 19 campuses of Penn State provide access to 1800 engineering students per year. These students can take the first-year engineering course at any of the 19 locations. This presents a serious challenge in terms of ensuring consistency in course expectations, competencies, content, and types of learning experiences offered at the various locations.

The key to implementation of a course that successfully meets the course expectations at multiple campus locations is that the faculty teaching the course must have “ownership” of the course.

Ownership can be achieved by allowing faculty to tailor the course according to her or his interest, expertise, and resources available.[3] When more than one faculty member teaches the course in geographically dispersed campuses, this will be a shared ownership or collaboration. This concept of ownership of the course, or delegation of responsibility, is specially important when teaching design courses, where the success of the course is heavily dependent on the instructor's enthusiasm for the course.

Providing ownership is a dramatic shift from the traditional model, where faculty were told exactly what topics and chapters to cover by their predecessors based on a specified course outline. With a uniform course outline it was assumed that the course is uniform among the campuses. However, due to various constraints at the two-year colleges it is often very difficult to effectively implement a design curriculum developed at a different institution unless the curriculum was customized to the local resources. Furthermore, if the curriculum demands continuous curriculum improvements, it is very unlikely the faculty will take initiative to make the continuous changes unless the they have a sense of ownership for the course. Therefore, implementation of a design course using a uniform course outline is not often effective. In fact, in the Penn State system it was evident that even through we had a uniform course outline the course implementation and objectives varied significantly from campus to campus.

The new curriculum follows a competency based model. This model allows faculty to define their own course outline satisfying a specific set of competencies that is uniform across the system. This allows for proactive curriculum improvement, which demands collaboration through sharing of course materials.

The new curriculum has the following features:

- Competencies and goals for the course are defined, which were developed by a team of faculty from all majors with input from industry.
- Faculty have the freedom to teach the course in their areas of interest using the resources available to them, as long as the competencies are satisfied.
- The course content is defined by the course outline and the assigned design projects. The course outline is treated as a contract between the students and the faculty. The course outline is required to show that the course meets the defined competencies. The outlines are evaluated annually by a team of faculty.
- Course resources, such as workbooks, textbooks, notes, design projects, developed by faculty are shared through a WWW database.
- Student evaluations are performed to monitor the quality of the course.

COLLABORATION & COORDINATION MECHANISMS

To implement this new model a collaborative project was developed, (which was funded by AT&T Foundation and Penn State Center for Academic Computing), to implement systemic changes that will sustain the coordination among campuses and industry using Information Technology. The strategies for implementing the changes are as follows:

Strategy A*: Develop a resource database using the World Wide Web to share curriculum-related information.*[4]

Faculty collaboration: To enhance collaboration, all faculty teaching the first-year design course in the 19 campuses are required to place the course material on-line. Providing course materials and resources that can be accessed anytime and anywhere allows students greater flexibility in conducting work outside class and enables instructors to view and select materials from a comprehensive resource database to which all faculty contribute. Some of the on-line resources that can be accessed include project database with images illustrating sample projects, course calendars, descriptions of weekly assignments, up-to-date grade information, class policy, and course material used. In addition, by using the WWW, secondary curricula resources are virtually limitless, and can be linked where appropriate. For example, a design may require patent searches and therefore, links to patent search engines will be very valuable.

On-line Student Portfolio / Projects Database: [5] All students taking the first-year engineering course will be required to be proficient in the use of information technology. Students are required to document their work and make it available on-line. Therefore, all design projects done for the course will be placed on-line, and will be assembled as a project database. The project database can be accessed by students. The same database can be used by other faculty as a resource for design projects.

Strategy B*: Provide faculty development workshops to encourage the use of information technology in the course.*

In order to institute systemic changes in the practice of coordination, the faculty must be proactive in the use of technology. This project provides the opportunity for the faculty to develop their skills in the use of the technology. In addition, the workshops provide resources and mechanisms to remain current with changing technology. Regional faculty workshops are held to give hands-on experience in developing the on-line course material. These workshop offer basic training in hypertext markup language (HTML) for the Web, and the follow-up workshops offer advanced training in HTML.

Strategy C*: Provide matching resources to acquire computer hardware to implement the technology.*

Grant money was made available to provide matching funds for hardware and software to the faculty teaching the first-year engineering course. The objective is to help faculty acquire appropriate hardware and software that can be used to develop and access innovative course materials. The broader goal is to develop a multimedia resource database for the course, including project ideas contributed and utilized by faculty. A commitment of matching funds from the local resources is required.

Strategy D*: Develop mechanisms for industrial collaboration in student projects using video conferencing technologies.*

Over the years we have had some modest, but valuable, industrial participation in the curriculum. However, bringing in active industry involvement is a challenge. This is rather difficult for campuses that are not located close to industrial sites. In addition, most forms of industrial participation involve significant commitment by industry, which may involve engineers traveling and one or two days away from work to meet with students for a few hours. This is certainly not feasible in the long run at a time when the industries are operating on lean budgets. Input from industry managers and practicing engineers was critical in the development of program competencies and will continue to be important in course delivery.

This project is testing affordable tele-conferencing technologies to enable frequent discussions with industry sponsors. For example, practicing engineers can participate in class discussions involving design projects on a weekly or bi-weekly schedule without leaving their offices. Video conferencing has been pilot tested using the CU-SeeMe[6] software. The students react very positively during these sessions. This exposure to engineering role models is very valuable for retention of students who have no such role models among their friends or families. It is clear that this type of interaction will be a very strong feature of the design courses. The CU-SeeMe software performs relatively well as long as the network traffic is low. Most industries are skeptical about using their Internet access for tele-conferencing, since it requires high data transmission rates and defense industries may have security obstacles. However, video conferencing technologies are evolving rapidly, and several affordable alternatives are available today, such as the ProShare system by Intel[7] or the PictureTel[8] system.

EFFECTIVENESS OF INSTRUCTIONAL MATERIAL

Innovative learning environments necessitate different assessment measures and evaluation procedures. Consequently, the tools for evaluation that are most appropriate in this context are those which are more comparative and qualitative in nature. Additionally, the ability to assess enhancements in faculty's teaching practices and students' learning processes in this project is greatly limited by how recently these practices have actually been implemented. The majority of assessment activities are in the process of being developed and implemented at this time. One area of interest is the long-term student progress. Assessment instruments are currently being developed to study the following issues:

- Student retention
- Integration of engineering processes into later courses
- Instructor surveys are being developed to determine how the instructional system is enabling collaboration among faculty and their use of the Web as a course resource.
- Upper level engineering faculty surveys are being developed to determine if students are coming into their upper level classes equipped with a higher level of engineering competencies (teamwork, problem solving, technical skills).

The instruments will be made available on-line via WWW to allow for wide and prompt distribution of the survey, and will allow for automated processing of the data.

From the overall assessment of the database an external reviewer, such as a ABET reviewer, will have the opportunity to assess the effectiveness of the course as implemented at all the 19 campuses. Furthermore, this level of collaboration among multiple campuses will not only nurture an environment for continuous improvement, but force faculty and students to be accountable for the quality of the course.

CONCLUSION

Curriculum coordination and faculty collaboration in geographically dispersed institutions is possible today with information technology. The use of information technology with an appropriate delivery network, and an integrated learning infrastructure will continue to be a priority for future engineering curricula. The technologies we use to access information, the volume of this information, and the format of this information, will rapidly change the nature of engineering education.

To manage change we must provide faculty incentives to take "ownership" of the course and nurture faculty collaboration. Providing "ownership" for the course would mean breaking down the course requirements to competencies, which will be met by the interest, expertise, and resources available to the faculty. This type of flexibility is an essential ingredient for continuous curriculum improvement, and only through such incremental changes can we meet the demands of the future engineering curriculum. The value of this approach is soon to be tested at Penn State since beginning July 1, 1997, all the commonwealth campuses at Penn State will either be independent or belong to a new independent college. Thus, the relationships between faculty teaching the first-year course at different locations will depend purely on collaboration. As far as we can see, the model will not need to be changed at all. Indeed, in principle, we could include non-Penn State institutions.

The model used allows us to exploit both delegation and collaboration as a means of handling continuous change. The silent partner that creates the environment of change is the information technology. Therefore, collaboration and coordination seems to be the necessary mechanisms to manage change.

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