

Enhancing the CE Project Courses in the BSCE Curriculum of FEATI University

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INTRODUCTION

Engineering projects is often used to apply to science fair projects or other projects that involve engineering in some way—that is, in which something is built, a loose understanding of engineering—but are not created following the engineering design process [1,8]. That this happens with science fair projects, for example, may be because scientific inquiry has long been taught in school, while the design process has not received nearly as much attention. It can also happen because science fairs may require that project entries follow the steps of scientific inquiry. The second meaning of engineering projects refers to projects that are like the first in every regard except that they do use the engineering design process.

Different engineering disciplines are built upon the same set of general principles for systematically solving problems and designing products. Engineering students from different fields usually begin by taking courses together that teach the fundamentals of engineering and professionalism in engineering [1,9]. This will then set that applicant apart from other applicants who may have held the same position and title, but don't appear to have contributed as much to the organization they worked for by comparison. Engineering students or graduates who have not yet had professional engineering experience should also include measurable achievements on their project engineer resume, even if those accomplishments are exclusively academic [10,11].

In 2006, as part of implementation of recommendations from the Curriculum Reform Committee of FEATI University of Civil Engineering, a new course “Civil Engineering Project” was developed for inclusion into the Department of Civil Engineering curriculum [2]. This was a revival of a similar course taught in the eighties at FEATI University but had been discontinued due to changes in the department's plans. The overall purpose of the new course was to learn students from cross-disciplinary communication, which means being familiar with the range of research practices applicable to construction and management engineering, geotechnical engineering, highway and transportation engineering, structural engineering, and water resources engineering, and design systems concepts in the way undergraduate students plan, design, evaluate, and manage civil engineering structures and facilities. Also, it was

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envisaged that the new course would provide the future engineers with greater awareness of the consequences of their designs from the perspective of the ecology, the economy, the social and cultural environment, and other performance measures associated with sustainability. The course was approved by the Curriculum committees in 2007 [4,6]. The establishment of the course at FEATI seems to be consistent with a global trend where civil engineering departments seek to infuse innovations and technologies perspective to their traditional civil engineering curricula. Obviously, this development arose out of the worldwide recognition that the developers of civil engineering projects need not only the traditional skills of physical or operational design or construction but also the skills to evaluate alternative designs, construction processes, and operational/maintenance techniques on the basis of a wide range of “external” performance measures.

At last, civil engineering project course seems to come of age. In a relatively short passage of time, this emerging and important discipline has produced considerable information to warrant its advocates to push for its expansion most especially in the field of civil engineering. The mandatory offering of the 2008 BSCE curriculum has called for the expansion and update of knowledge in the field by those who are tasked to teach the course. A three unit course may be insufficient to cover the many aspects of civil engineering project, however, with careful designing of the course coverage, sufficient topics can be covered in lectures and a number of activities can be produced in the laboratory.

This paper discusses the elements of the Civil Engineering Project courses. These elements include basic course information, course content, and how this course differs from similar courses elsewhere. The paper also presents the mechanisms adopted for instructional delivery, the schedule of lectures, and the phases of civil engineering project courses. The course content is described in the context of the three key underlying themes that serve as the central philosophical pillar around which the course concepts revolve.

1 CIVIL ENGINEERING PROJECT COURSES MOTIVATION

The motivation for the course rings across the entire terrain of civil engineering, in fields including structural, geotechnical, construction, transportation, and water resources engineering [5]. For any real or virtual system in any of these fields of civil engineering, the civil engineering project courses involves needs assessment, planning, design, construction, operations, monitoring, preservation, and termination. The technical design of specific elements of systems in these fields is well covered in traditional courses at FEATI University as in most other universities. Most working engineers are typically involved in only one or two of these development phases of civil engineering project. However, it is beneficial for all engineers, particularly in the present era, to acquire an overall and explicit bird’s eye view of all phases of the system development cycle so that decisions they make at any phase are holistic and within the context of the entire cycle. Another motivation is that the costs and benefits of civil engineering investments permeate every sphere of our lives including safety, mobility, security, and the economy, and thus need to be assessed comprehensively in any decision-making at any phase of civil engineering projects development. Also, the adverse impacts of civil engineering projects, such as environmental degradation and community disruption are often evident and need to be assessed and mitigated proactively. This course demonstrates that these motivations can be addressed when civil engineers view explicitly the development of their systems within a phase’s framework, and when they acquire the requisite tools needed to address the tasks at each phase.

2 BASIC COURSE INFORMATION

2.1 CE 518

This two-hour lecture course is designed to support undergraduate civil engineering students in developing their research project and to assist them in defining their mode of enquiry. The course has been constructed to guide students through a range of issues and considerations which should inform their general approach to research [3]. It will give students a general introduction to undergraduate research, its methodologies, its challenges and its organization, including in creative practice. Students will be introduced to a range of research tools and will be equipped to plan and organize their research, as well as to communicate their findings.

The course will covers the following: (a) The practicalities of research, including setting and achieving realistic goals, planning, working in a team, using resources, presentation skills, and meeting institutional requirements and expectations of good practice. (b) Techniques for advancing knowledge and understanding, such as setting up a programmed of reading, literature review, techniques of archival research, interviewing, observation studies, ethnographic research, gathering evidence, quantitative methods, and creative practice and design as research. (c) Development of a critical framework in which to review research and research methods, taking account of the contested nature of research practice.

2.2 CE 519

The emphasis of this three-hour laboratory focus on the preparation of a conference paper, with a particular focus on the research methods that students will employ or (in conversation with his supervisor) another topic that is more relevant to students current stage in the research process. [7]. Students prepare an abstract between 300-400 words in any field of civil engineering primarily pertaining to the research approach or methods that students plan to use. The abstracts will be distributed via email to student colleagues for review and feedback. Each abstract review should be about 300 words. Students submit a hard copy of each abstract review to the course tutor at the start of class, with one copy for each abstract author (on separate sheets) headed with their respective abstract titles. Finally, students submit a 3,000-word written essay after the conference. They are encouraged to lead in the organization of the conference, and there will be opportunities to discuss criteria for review, appropriate format, organization, publicity and dissemination during class sessions

2.3 CE 527

This two-hour lecture course is designed to be taught in a seminar style with extensive dialogue among the students, instructor, and resource persons [7]. In-class discussions should be enhanced with additional student-advisor (and committee, if appropriate) meetings. Students are expected to be prepared for all class meetings. Since lecture will be minimized, it is essential that all students be prepared to contribute to all in-class discussions and activities.

As shown in table 1, the following topics and readings are needed to meet the goals and needs of the students.

Table 1. CE 527 Course Outline

UNIT NO	TOPICS
	Introduction
1	Syllabus, administrative procedures, using the online catalogue, ATLAS, internet (learn and Skype) and thesis checklist (Faculty of Civil Engineering)
2	Writing & Choosing a Topic and Title
3	The Thesis within the Thesis & Chicago Style
	Research
4	Managing research and preparing a working bibliography, working bibliography form and style, speedy reading and the craft of research
	Organizing Your Thesis & Further Research Issues
5	The elements of a thesis proposal, successful dissertations and theses, experience research social change, methods from the margins and working bibliography.
	The Thesis
6	How a thesis differs from other kinds of writing?, the architecture of a thesis, and thesis assessment form" (Faculty of Civil Engineering)
	Supervisor & Outlining
7	How To Get the most out of your supervisor? , "choosing an advisor / committee and review of literature.
	What Readers Look For?
8	Revising, introductions and conclusions and look ahead to methodology
	Methodology, Outlining and Writing
9	Revising for Style
	The Finished Copy & Ethics Review
10	Procedures After a Thesis Proposal Has Been Approved." (Faculty of Civil Engineering)
	Thesis Proposal Presentations
11	(Should include an outline, conclusion, and revisions of previous sections
	Thesis Proposal Presentations
12	What next? Administrative requirements, procedures, and deadlines.

2.4 CE 528

This three-hour laboratory course deals with both the theoretical and practical aspects of designing thesis research and successfully defending the design in a proposal hearing [7]. The purpose of the course is to assist students through the proposal and thesis writing processes. Moreover, this course is designed to synthesize the knowledge and skills developed in previous research course and apply them to the civil engineering undergraduate thesis process. Students learn about all aspects of the process of developing and carrying out the undergraduate thesis, and students gain an understanding of standards and expectations that students need to meet to be successful in completing the thesis process. Throughout the course, students are required to work closely with their major advisor/ thesis director and committee, as appropriate. Student performance in the course will be assessed by the Department Head of Civil Engineering in collaboration with each student's major advisor. To make substantial progress, it is essential that students set and meet aggressive goals and meet regularly with their major advisor/dissertation director to ensure the dissertation is progressing in a focused and high quality manner.

Specifically, students in this advanced research course will gain a better understanding of how to accomplish the following actions: (a) Select the thesis problem. (b) Identify and work productively with an advisor/ thesis director and faculty committee. (c) Conduct productive student-faculty interactions. (d) Organize and manage thesis-level research. (e) Organize and write the thesis. (f) Meet departmental, college, and university requirements. (g) Form and contribute to a thesis/dissertation

support group, as appropriate. (h) Handle the politics of the dissertation process. (i) Schedule and successfully complete a pre-preliminary or preliminary exam. (j) Prepare for the final oral examination.

Students will be evaluated through written examinations, practical examinations, projects, and class participation. Each instructor reserves the right to establish additional methods of assessment. Artefacts for the portfolio may be required.

As shown in table 2, the following course outline is needed to meet the goals and needs of the students.

Table 1. CE 528 Course Outline

UNIT NO	TOPICS
1	Managing research and preparing a working bibliography, working bibliography form and style, speedy reading and the craft of research.
2	Successfully defend the proposal before faculty of the university.
3	Follow with submission of a complete IRB application which includes the research protocol, certifications and signatures, and curriculum vitae of principal investigator to the university Institutional Review Board for civil engineering subjects research (IRB).
4	Student must also submit an IRB application approved by Thesis chair.

3 PHASES OF CIVIL ENGINEERING PROJECT COURSES

3.1 Phase 1: Planning

This phase must be carried out in a semester prior to the semester of the thesis implementation, i.e. it will be carried out each semester for the coming semester. Civil engineering department has to establish a thesis committee through the department council and under the supervision of the civil engineering department head [1].

By the sixth week, from the semester prior to the CE 518 and CE 519 semester, the thesis committee needs to ask the civil engineering department head/senior CE faculty members to give proposals for new thesis by emailing or distributing thesis form among them.

By the tenth week, the thesis committee needs to collect the thesis proposals. It is the faculty member's responsibility to submit his idea(s) on the thesis form to the thesis committee. The following points are recommended to be included in each idea-proposal: (a) Thesis title. (b) Thesis adviser. (c) The track/duty of each student (option). (d) The requirements-if any –like (prerequisites-elective courses-specific GPA...etc.). (e) A time chart (Gantt chart is recommended) for each track (option). (f) Brief description. (g) Required number of students.

By the 13th week, the committee has to announce the thesis proposals for the coming semester using the thesis form 1. The announcement may be electronically (mail and/or on the department site) and/or posting on the department main announcement board.

Each proposed thesis, student has to review the committee announcement (mentioned in the previously activity) and selecting three thesis proposals that may fit his capabilities and arranging them according to his priorities using thesis form 2. His thesis form 2 must be submitted to the thesis committee not later than Monday of the 15th week from the semester prior to the CE 518 and CE 519 semester.

Nomination teams of three (3) students for each thesis are the responsibility of the thesis committee. The proposed main criteria for this nominations are (a) the student choice priorities. (b) The validation of the requirements. (c) The intention of taking the proposed elective courses. (d) The student GPA.

Afterward and by the final exam week, from the semester prior to the CE 518 and CE 519 semester, the thesis committee has to issue the final list of the students' nominations for the thesis. Form thesis 3 is issued to be used for the announcement of the nominations.

The thesis committee has to set and announce the proper times for the two interim assessment reports. These reports will be discussed later.

After the student-thesis assignment-the remaining project ideas may be planned for the CE 528 and CE 529 semester. A one year plan is recommended to be established by the thesis adviser.

3.1 Implementation

The first meeting between each student team and the supervisor(s) may be held on or before the first week of the CE 528 and CE 529 implementation semester. The following activities may be held during this semester: (a) the supervisor(s) need to explain to their students the thesis objectives and outline, the project stages, the follow up policy, the grading system, the urgent care form, the preparation of the documentation, the final report and the presentation [1].

The supervisor(s) need to discuss with their students the detailed time plan for the thesis and guide the students to prepare and sign the tasks' sheet whereas the students have to prepare the role(s) of team-reporter for the rest of the semester.

On the CE 528 and CE 529 semester, students have to meet their supervisor(s) weekly and use the thesis form 6 to report this meeting and the task assignments. The form must be submitted to the supervisor and kept (by him) in the project portfolio. The supervisor(s) need to take notes of the student attendance, punctuality and the achievement of their previous week's assignments.

3.2 Examination of the thesis and evaluation strategy

This phase is applied during the CE 528 and CE 529 implementation semester.

By the 14th week, the thesis committee has to announce the assignment of the exam committees for the running thesis and the arrangement of the final presentations based on the college calendar. The thesis form 8 is to be used for those announcements. The students have to review the thesis committee announced for the presentation schedule and prepare the final report and final presentation based on the given expectations.

By the first day of the final exams, each team has to submit three draft copies of the final thesis report in the supervisor(s). The copies are to be distributed by the supervisor on the thesis examiners for evaluation. Before the presentation day, a thesis committee needs to arrange with thesis supervisor(s) the good time to evaluate the thesis final report, design approach and final product. Thesis form 9 is to be used for this evaluation. The form must be submitted signed to the supervisor on the presentation day.

On the presentation day, a thesis committee needs to attend and evaluate the presentation with the use of the thesis form 10. The supervisor(s) need to do the following: (a) Collect the report's evaluation forms from the thesis form 9 and thesis form 10 and calculate the average. (b) Fill the final project evaluation form- one thesis form 11 per each student and report the final grade to civil engineering department head.

After the presentation, it is the students' responsibility to take into consideration the examinees' comments and corrections in issuing the final project report. They have to submit three final copies to their principal supervisor. The final report must meet all report expectations and satisfies the associated checklist. The final copies must be signed by the principal supervisor to assure that all corrections, remarks, etc. were covered. The copies must be submitted to the civil engineering department head for university library.

The evaluation of each student will be based on two criteria: individual evaluation and entire team evaluation [1]. Each student will be evaluated individually based on his semester work which weights 40% of the total final grade and his oral presentation which weights 10% of the total final grade. The rest of the total final grade 50% is reserved for the entire team evaluation. A 40% of the total final grade is devoted for the written report, design approach and final project product, and 10% is devoted for the presentation materials. Figure 1 shows the distribution.

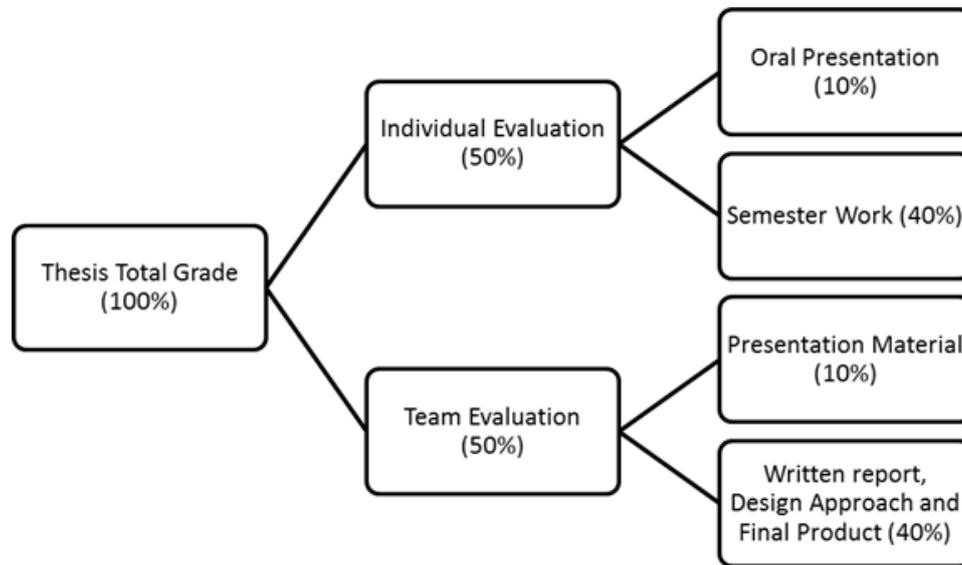


Fig. 1. Distribution of Final Grades in Civil Engineering Project course

3.4 LEASONS LEARNED AFTER FIVE YEARS OF COURSE IMPLEMENTATION

A variety of techniques learned from the literature were used to generate feedback information from the students before, during and after the course. The formal end-of-semester student course evaluations yielded critical information by identifying areas that could be further enhanced to facilitate and streamline the instructional process. This information included quantitative data and well as qualitative assessments. The informal start-of-semester and mid-semester evaluations provided useful hints on students' background strengths and interests. The evaluations helped in streamlining and enhancing the course further. It was found that the thesis particularly play a valuable role in the didactic experience. Students stated that this component of the course provided a pedestal for them to think in perspectives other than technical performance and thus earned greater appreciation of the need to duly incorporate a suitable range of performance measures at any phase and in any task of civil engineering projects development. They gained appreciation of the need to consider performance measures such as user costs, environmental impacts, and sustainability in general. Also, it was learned that the civil engineering pro helped students acquire the confidence to translate real world problems into solvable constructs using mathematical modeling or simulation. Many students who took the course indicated that they benefitted greatly from the course concepts, particularly the explicit explanation of civil systems development from the perspective of phases, tasks, and tools. A number of students opined that the course is one of the most important courses of their undergraduate years at FEATI University and expressed a desire to pursue further studies in engineering systems at Purdue or elsewhere.

4 SUMMARY

This paper presents an overview of the Civil Engineering Project courses at FEATI University, a core requirement in the undergraduate curriculum of Civil Engineering Department since 2006. These courses were established as part of implementation of the School's 2008 strategic plan that sought to address new challenges in a rapidly changing professional, educational and institutional environment. The paper discusses the motivation for the course, course information, the course content, continuing concepts and paradigms, mechanisms utilized for instructional delivery and didactic resources, and lessons learned after five years of course implementation, and on-going development of the course. The strategy of team teaching, where the three faculty members work cooperatively with the same group of students will be adopted in selected topics. The effort in enriching the learning experience of students in Civil Engineering Project is an answer to the demands of present time for civil engineering graduates who are innovative, creative and concerned. Their role as future civil engineers requires knowledge and concepts in the multidisciplinary field of innovation and research to enable them to become more successful in their field of specialization.

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