The Sooner City Project: A 5-Year Update

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Abstract

The Sooner City project at the University of Oklahoma (OU) seeks to reform the traditional civil engineering curriculum by including design projects at every level of the curriculum, not simply as a senior capstone project. The project can be implemented without changing the traditional course sequencing, which enhances faculty buy-in. It is part of a larger movement to reform engineering education by teaching students to: contribute in a dynamic, team-oriented professional environment, use advanced critical thinking skills, use computers proficiently, and communicate effectively to other engineers and to the public. Sooner City is in its 5th year at the OU School of Civil Engineering and Environmental Science (CEES). Five CEES classes per semester, freshman through senior, have incorporated design projects for a virtual city. Projects have ranged from concrete footings for virtual office buildings to floodplain analysis and bridge crossing design. This paper presents key results from two important tools used to evaluate the success of the Sooner City project: questionnaires completed every semester by students in Sooner City courses, and interviews of the professors of those courses. Responses indicate that the project is realizing stated objectives.

1. Overview of the Project

1.1 Background

The Sooner City project, supported by NSF (Action Agenda, NSF EEC 9872505), seeks to reform the traditional civil engineering curriculum by threading a comprehensive, integrated, infrastructure design project across the curriculum, beginning in the freshman year. Basically, freshmen are given a plat of undeveloped or partially developed land that, by the time they graduate, is turned into a blueprint for Sooner City's infrastructure[19]. Among other things, the project promotes five outcomes not fully addressed by traditional curricula, but which are emphasized by the NSF Engineering Education Coalitions and ABET 2000: team building, communication, leadership, design, and higher level learning skills.

1.2 Project Philosophy

Students are taught to view engineering design as a constrained optimization problem, viz, given a design task, raw data, and constraints (technical, political, economic, or social), they develop the "best" solution from among multiple alternatives. Each engineering course is devoted to a different component of the overall design, but the components are structured so that the solution often requires cross-course integration, both vertical (e.g., freshman/junior) and horizontal (e.g., two concurrent senior courses). For example, one design task is to size a water supply reservoir to meet municipal demands. To complete the design, a junior-level water resources class (water supply) interfaces with a senior-level hydrology class (inflows) and a junior-level soil mechanics class (earth dam). Distinct classes act as sub-consultants with design data and calculations shared between them via common meetings, the web, or formal engineering reports.

1.3 *Key Features*

Sooner City provides an ideal venue for other reform initiatives, such as: team learning, peer mentoring, wireless laptops in the classroom, and just-in-time learning (students gain skills as needed). Thus, students learn technical material using the latest hardware and software, while at the same time learning how to communicate (design reports/presentations), how to function effectively on a team, how to balance the political/social/ethical aspects of engineering projects, how to teach themselves (researching design solutions/new analysis skills), how to engage in higher level thinking skills (critical analysis of multiple design alternatives), how to self-assess (learning portfolios[9]), and how to be effective leaders on projects.

Sooner City's web-based nature facilitates distance learning and outside-of-class activities.[31] Included in the development are content-rich multimedia modules that combine animation, graphics, text, and sound to enhance student learning.[28]

Sooner City unifies the curriculum by promoting horizontal and vertical integration, so students learn a holistic systems approach to engineering projects, rather than taking isolated courses that appear as independent entities. Sooner City also provides a framework for multidisciplinary integration.

Sooner City essentially turns the engineering curriculum into a four-year design experience. Consequently, when students enroll in the traditional senior "capstone" course, they are better prepared to handle complex, multidisciplinary projects involving other engineers (mechanical, electrical, and industrial) and environmental scientists, the hallmark of the department's capstone course[16].

1.4 Portability

Sooner City is very portable, both in concept and in wholesale adoption. Because no change is required in the traditional course sequencing, other civil engineering departments can adopt the design project without a major curricular overhaul (except, obviously, for a change in the name of the city!), which enhances faculty buy-in. Moreover, any engineering discipline that requires integration of knowledge to solve complex problems lends itself to the methodology. For example, industrial engineering could identify Sooner Factory and tie operational and managerial studies to this workplace, or petroleum engineering could define the Sooner Bay oil field and tie extraction, transportation, and processing activities to it.

1.5 Impact at OU and Other Institutions

Within OU's College of Engineering (CoE), Sooner City serves as a catalyst for one of the Dean's strategic initiatives, which seeks to make project-based education the norm for the college. To reach beyond OU, the project team hosted a national workshop in 2000 attended by 24 faculty from diverse institutions[18]. A second workshop is scheduled for 2002/03. Based on feedback, many of the participants are trying to adapt part of the Sooner City concept. In fact, a special session at the 2001 ASEE National Conference, organized by workshop participants, was dedicated to project implementation issues. Rowan University is at the forefront of testing the project's portability, with support coming from an NSF A&I (Adaptation and Implementation) grant. The University of Wisconsin-Platteville also received an NSF A&I grant and will be piloting some aspects of the Sooner City project. And this year, the University of Cincinnati is preparing a related A&I proposal. OU is supporting all of these efforts by serving as a consultant for project implementation.

1.6 Indicators of Excellence

The following metrics indicate the degree to which the project has been received by the educational community.

Selected Educational Awards to Members of the Project Team:
- 3 NSF CAREER Awards (integrating research and education)
- 3 ASEE Dow Outstanding New Faculty Awards
- 4 OU teaching and research awards

Awards for the Sooner City Project
- NSF Course and Curriculum Development Award (seed money for concept)
- NSF Action Agenda for Systemic Engineering Education Reform (major funding source)
- Oklahoma Regents Instructional Technology Excellence Award (1999)
- Oklahoma's Williams Faculty Innovator Award (2000)

Other Project/Individual Recognition
- 5 Invited Presentations at National Conferences (1998 and 1999 ASEE/NSF Project Showcase, 1998 and 2002 ASCE National Convention, 1998 NSF CAREER Workshop).
- Featured in ASEE's Prism Magazine[2]
- Featured in NSPE's Engineering Times Newsletter[27]
- Featured in OU's "Spotlight on Teaching" Newsletter[10]
- Numerous ASEE journal articles and conference presentations[16-19, 28]

1.7 Need for Engineering Education Reform

At many institutions, undergraduate engineering education has become outdated. During the past five decades, the following paradigm, for the most part, has become the norm: lectures on technical concepts, little or no discussion, individual homework on idealized problems, and problem-solving exams. Complex design problems, if used at all, tend to be introduced in upper-level capstone courses. Moreover, many institutions have been slow to adopt information technology into the classroom, relying instead on hand-held calculators and traditional design charts and nomographs. While this traditional formula has produced generations of competent design engineers, it is ill-suited to produce graduates who can contribute in a dynamic, team-oriented environment, who have advanced critical thinking skills, who are proficient with computers, and who can communicate effectively with management and the public. This same traditional system is also discouraging many talented engineering students; the attrition rate in engineering exceeds 40% at many leading institutions. Students commonly leave engineering because they fail to see relevance in introductory classes and because of a lack of nurturing during the first few years, particularly by faculty members from the student's chosen discipline. A particularly disturbing aspect of this trend is that it comes at a time when engineering can ill afford to lose the best students to other disciplines. [1, 3, 4, 5, 8, 11, 12, 13, 15, 20, 21, 22, 25, 29, 30]

Engineering education reform is part of a larger movement.[6] Perhaps the highest profile report about the need for reinventing undergraduate education came from the Boyer Commission, entitled "Reinventing Undergraduate Education: A Blueprint for America's Research Universities."[7] According to the commission, research universities have failed the undergraduate student population. The commission recommends ten pivotal approaches to radically improve today's educational paradigm. Likewise, the Kellogg Commission on the Future of State and Land-Grant Universities recommends that we create new learning environments.[14] Both commissions indicate that major curricular innovations are needed, not minor adjustments. Seely documents similar major innovations in engineering education in the early part of the 20th century.[26]

Regarding Sooner City, we note that extensive research has shown the importance of project-based learning for retention and in-depth understanding of concepts.[30] A recent resource that provides the scientific basis for project (experiential-based) learning is How People Learn: Brain, Mind, Experience, and School, a publication of the National Academy of Sciences that summarizes the current state-of-knowledge with respect to educational pedagogy.[24] Table 1, taken from How People Learn, illustrates the factors that are important in a well-designed learning experience.

Table 1. Cognitive activity and structure of knowledge.

Organized Cognitive Activity	*Structure of Knowledge*	
	Fragmented	*Meaningful*
Problem representation	Surface features and shallow understanding	Underlying principles and relevant concepts
Strategy use	Undirected trial-and-error problem solving	Efficient, informative, and goal oriented
Self-monitoring	Minimal and sporadic	Ongoing and flexible
Explanation	Single statement of fact or description of superficial factors	Principled & coherent

Referring to Table 1, we note that use of well-designed projects (e.g., Sooner City) facilitates structuring the knowledge to support meaningful learning. For instance, the project context supports the development of goal-oriented strategies. The project structure must be augmented with education and explanation about the underlying principles and concepts. Self-monitoring is reinforced by requiring teamwork and intra-team feedback. Students in Sooner City must continually self-assess the multiple design options.

2. Timing of Activities and Cohorts

Implementation of the Sooner City project started with the freshmen-year course Introduction to Engineering in Fall 1998. Various courses that had Sooner City projects and the semesters they were taught are shown in Table 2. A cohort shown in Table 2 indicates a group of students that would have graduated in four years following the prescribed curriculum. A typical student, however, takes more than four years to graduate and therefore would have likely taken courses belonging to more than one cohort. A student not strictly belonging to a cohort complicates the evaluation activities. For example, in order to evaluate whether the Sooner City project improved performances in the capstone group design work, we have to compare the performances of various groups together with the total number of Sooner City courses taken by each group and not just the performance of a Sooner City cohort against a non-Sooner City cohort.

Table 2. Sooner City Courses and Cohorts.

Semester	*Cohort 1*	*Cohort 2*	*Cohort 3*	*Cohort 4*
Fall '98	ENGR 1112			
Spring '99	ENGR 1213			
Fall '99	CE 2553	ENGR 1112		
Spring '00		ENGR 1213		
Fall '00	CE 3363 CE 3212	CE 2553	ENGR 1112 (2 sections)	
Spring '01	CE 3234		ENGR 1213	
Fall '01	CE 3663	CE 3363 CE 3212 CE 3414	CE 2553	ENGR 1112 (2 sections)
Spring '02	CE 5333 CE 4123	CE 3673 CE 3234	CE 3403	

Notes: ENGR 1112 – Introduction to Engineering, ENGR 1213 – Graphics and Design, CE 2553 – Surveying, CE 3403 – Materials, CE 3363 – Soil Mechanics, CE 3212 – Environmental Engineering, CE 3234 – Environmental Engineering II, CE 3414 – Structural Analysis, CE 3663 – Structural Design (Steel I), CE 3673 – Structural Design (Concrete I), CE 4123 (Open Channel Flow), CE 5333 – Foundation Engineering.

3. Overview of the Evaluation Protocol

To evaluate the success of the Sooner City project, a comprehensive assessment plan is in place, including both formative and summative evaluations. The assessment activities are collecting information to provide data-based, criterion-referenced answers to the following questions. *Formative*: (i) Is this project working as anticipated? (ii) Are any significant changes needed? *Summative*: (i) Will the retention rate of Sooner City students be improved? (ii) How well do the

Sooner City students retain concepts and knowledge from previous courses? (iii) How well do the Sooner City students apply these concepts in solving comprehensive design problems?

Two types of custom-made examinations are being used in the summative evaluation. The first is a Readiness Assessment Test (RAT) which tests retention of material taught in previous courses. The second is a Comprehensive Application Test (CAT) which tests students' design ability across several courses. In addition, faculty panels evaluate the oral and written presentations of the students' capstone design projects to determine whether teams with a higher percentage of Sooner City participants perform better than those with lower percentages.

The focus of the following discussion will be on the main formative question: Is this project working as anticipated? Every semester, student questionnaires and faculty interviews have been administered and evaluated to determine whether the Sooner City Project is accomplishing its goals.

4. Course Evaluation Procedures

4.1 Overview of Evaluation Procedures

The core of the evaluation process is collecting and interpreting feedback from students and faculty involved in Sooner City courses. The students' perceptions are obtained from the mid- and end-of-semester online questionnaires, while each professor's perceptions are collected during an interview at the end of the semester. After the course ends, the Evaluation Assistant provides the professors and the Sooner City project managers a report on the responses.

The *questionnaires* ask students to rate the success of the course in achieving its stated objectives. Students are asked to indicate a numerical score (ranging from 1 – low success to 5 – high success) and also to write a qualitative reason for their numerical score. The project's Evaluation Assistant calculates the mean, standard deviation, and range of the responses to each question and summarizes the important themes in the qualitative responses.

During *faculty interviews* at the end of the course, Sooner City professors had an opportunity to comment on the success of course activities and make suggestions for the future.

4.2 Student Questionnaires

Early each semester, the Evaluation Assistant works with each Sooner City professor to develop the questionnaire, which includes 4 sections:

1. Course Objectives
2. Course Activities
3. Sooner City Project(s)
4. General Questions

1. The <u>Course Objectives</u> are the general educational goals and are directly related to the goals of the Sooner City project. The objectives frequently deal with the design process, problem-solving skills, as well as important course-specific skills. For example: "By the end of this course, students will…"

Develop the skills it takes to be an effective engineer, including teamwork, understanding the big picture, math and science fundamentals from an engineering perspective, and verbal and written communication skills. (freshman-level introduction to engineering course)

Understand and apply the various steps involved in water distribution analysis and design. (junior-level course).

Develop an understanding of the theory behind foundation analysis. (senior-level course).

2. The Course Activities are the in-class and homework exercises that make up the daily course routine. Some questions deal with course structure: lectures, group exercises, labs, and team teaching. Others deal with technology, such as laptop computers, virtual experiments, and class websites and digital drop boxes (for homework). Field trips, textbooks, and guest speakers are often included, as are Readiness Assessment Tests (RATs) in the courses that use them.

Note: RATs are modeled on those described by Michaelsen.[23] Students take RATs at the *beginning* of a unit of study to ensure that they are familiar with the required reading material before tackling exercises in which they must apply the concepts.

3. Questions about the Sooner City Project(s) deal with project objectives and activities, for example:

Doing the Dam Design Project in groups gave a sense of the usefulness of teamwork. (Introduction to Engineering)

Exercises like measuring the elevated water storage tower showed the importance of error analysis in surveying. (Surveying)

Doing a subsurface exploration proposal gave practice in real-world report writing. (Foundation Engineering)

4. General Questions
These are open-ended questions on topics not covered by the previous sections of the questionnaire. (See Results, below.)

4.3 Faculty Interviews

At the end of each semester, the professors teaching Sooner City courses were asked the following questions:

1. To what degree do you feel that the course accomplished its teaching objectives?
2. How effective were the teaching and learning activities, especially the Sooner City Project?

3. How did the course this semester compare with other times you have taught it? Did you do anything differently? If so, did the change(s) improve the course?
4. Given what you did to make this a Sooner City course, was your time and effort proportionate to the results, or disproportionate?
5. Do you have any recommendations about how to improve this course in the future?

After final grades have been turned in, the Evaluation Assistant prepares a report on the questionnaire and interview results for the professors and the project management team, including a statistical analysis of the quantitative responses and a discussion of the themes that emerged in the “reasons for your answer” responses.

5. Evaluation Results

5.1 Student Questionnaires

1. <u>Course Objectives</u>
Overview: The most important finding about the Course Objectives has been that most of the students agree that these objectives had been met in Sooner City courses. These major concepts are at the heart of Sooner City and appear in some form in the questionnaires of all Sooner City courses. They reflect the goal of producing engineering graduates who:

a. Have developed strong *design skills* through repeated practice, beginning in the freshman year
b. Can perform *critical thinking* and know how to go about solving complex, open-ended engineering problems
c. Are aware of the *inter-relatedness* of civil engineering subdisciplines and take this into account as they solve design problems.
d. Can use sophisticated application *software* as a design tool.

a. *Design skills*
Students in sophomore-level courses and higher have generally perceived that they gained valuable experience in design. (“Design is in everything we do in this course!” wrote one). Even the freshmen, who did not yet have a mature understanding of the complexities of the design process, perceived that they had practiced the basic steps.

b. *Critical thinking*
One of the most challenging concepts for young engineering students is that real-world design problems rarely have one unique solution. It is essential for students to learn to assess multiple alternatives during the design process. Most students have agreed that they had an opportunity to practice this, especially during the Sooner City projects.

c. *Inter-relatedness of civil engineering disciplines*
Many of the professors stress this concept throughout their courses, and the students generally agree that they had gained a greater appreciation of why engineers in different subdisciplines must communicate with each other. Sometimes groups of professors set up projects that required a transfer of information between courses (See Sooner City Projects, below).

d. *Application software*

Most students have been very enthusiastic about learning to use AutoCAD, FlowMaster, HEC-RAS, ARCVIEW, and other tools. ("I would *still* be crunching numbers if it weren't for this software!" wrote one.) To ensure that students became informed and critical users, several professors include exercises that highlight areas in which informed judgment, rather than simple number-plugging, made the difference in whether or not a project was successful.

2. Course Activities

While many of these questions refer to standard course activities (lectures, field trips, labs, etc.), the students' responses to two activities are particularly worth noting here, because they contribute directly to larger Sooner City goals: Readiness Assessment Tests (RATs) and team learning.

RATs reduce the time spent during lectures going over basic concepts and increase the in-class time available for problem-solving and team exercises in which students apply the concepts. RATs therefore directly support the Sooner City goal of providing higher-level-learning experiences for students. Although challenging, RATs were well-received by most students in the courses where they were used ("They really made me study," wrote several.).

Team learning is important in preparing engineers to function on professional project teams. It also provides a setting for learning how to solve complex design problems. Team work received mixed reviews from the students, primarily because some students were perceived by their team members as not carrying their weight, and it was often difficult to find times outside class to meet. On the positive side, most of the time students felt they had benefited from team projects, primarily because others in the group helped them understand difficult concepts, and because the projects were often too large to complete alone. Careful design of activities for teams can help reduce problems.[23]

3. Sooner City Project(s)

The most significant result was that students generally agreed that they had gained a greater understanding of the steps of the design process by working on Sooner City projects. Some were uncomfortable with the open-ended nature of the problems ("We never knew if our assumptions were correct"), but, overall, students reported that by the end of the course they felt more equipped to handle this sort of problem.

Another important goal of the projects was to teach students about the inter-relatedness of civil engineering sub-disciplines. Overall, the students felt that this had been accomplished. In particular, one innovative three-way project illustrates the usefulness of a central project like Sooner City in providing opportunities for cross-course interaction. Students in three upper-division courses (Reinforced Concrete, Foundation Engineering, and Macromeritics) cooperated on a footing design for a five story office building. The three classes functioned as engineering consulting firms with different responsibilities. The information flowed as follows:

Concrete:	Determine the building plan and specify the load on an interior column.-->
Foundations:	Using load specification from Concrete and own soil analysis, determine the size of a single column footing to support load.
Concrete:	Specify compressive strength and maximum aggregate size.-->

Macromeritics: Design a concrete mixture to meet the required compressive strength.

Concrete: Using strength and size input from Foundations and Macromeritics, design a reinforced concrete footing for the building.

One challenge with this and other cross-course projects was finding ways for the students to communicate their data, specifications, and results between classes. Helpful techniques include email memos and the videotaping of student presentations for viewing in "client" classes. Also proposed is a weekly one-hour colloquium time for all civil engineering students, where information can be exchanged.

4. General Questions
In this section of the questionnaire, students were asked to comment on things that had gone well in the course. Most often mentioned were the usefulness of the software they had used, the field trips they had taken, and the Readiness Assessment Tests.

Students also had an opportunity to suggest areas for improvement in the course. Typical comments dealt with the timing and quantity of assignments, and the desire for more field trips and more time for hands-on instruction on using the software. Interestingly, several students requested even more design practice, in the form of "mini designs" included in homework.

This section of the questionnaire also provided a place for the professor to ask program-related questions, such as reasons for taking the course, related courses taken, and the area of engineering the students intend to pursue as a career.

5.2 Faculty Interviews

At the end of the semester, the professors of Sooner City courses were asked to respond during an interview to the following questions.

1. *To what degree do you feel that the course accomplished its teaching objectives?*
In general, faculty felt that their courses had achieved these objectives, which was in line with the average student responses. The Sooner City projects were, for the most part, perceived to have taught design skills, critical thinking, and a hands-on familiarity with application software. In addition, many of the professors incorporate the inter-relatedness of civil engineering disciplines as an ongoing theme in their courses.

2. *How effective were the teaching and learning activities?*
Faculty responses to these questions have varied. They generally score the effectiveness of group work higher than their students did: faculty can see the skill-building taking place, but the students were more preoccupied by the difficulty of meeting outside class and the perception that some group members were not carrying their full load.

Professors have also noted a number of logistical problems, many of which were beyond their control: bad weather or construction delays prevented some field trips, computer or lab equipment failures interfered with projects, etc.

Professors and students generally agreed, however, on the success of team teaching, guest speakers, and Readiness Assessment Tests in enhancing learning.

3. *How did the course this semester compare with other times you have taught it? Did you do anything differently? If so, did the change(s) improve the course?*
Obviously, it is more time-consuming to introduce new procedures (such a Sooner City projects) into a course the first time than it is to refine them in subsequent semesters. The faculty generally feel that their time has been well spent. They also report that, once they had made one of their courses a Sooner City course, it was easier to introduce Sooner City projects in others.

Some of the more successful innovations made by faculty include: allowing students to choose whether to work individually or with a partner on certain projects, playing "concrete baseball" to practice concepts, using team teaching, inviting guest speakers from a different discipline, and using supplemental readings (e.g., *The New Science of Strong Materials: Why You Don't Fall Through the Floor*).

4. *Given what you did to make this a Sooner City course, was your time and effort proportionate to the results, or disproportionate?*
Professors have almost always agreed that their preparation time had been well spent, even at the beginning of the Sooner City project when considerable start-up time was required.

5. *Do you have any recommendations about how to improve this course in the future?*
The most frequent recommendations had to do with technology: ethernet standards, enough lab equipment to allow all students sufficient time, find ways to ensure that all members in a project group gain an understanding of all parts of the project.

5.3 Impact on Student Performance in the "Real" World

The project team received a preview of what future feedback from Sooner City graduates might look like. During the fall 2002 semester, one upper-division student participated in a pilot course entitled "Practical Learning Experience," in which he worked as an intern at a civil engineering firm for credit. He was given major responsibilities on a variety of site enhancement, roadway improvement, and airport improvement projects. In his final report on this experience, he noted several times that the readiness he felt for analyzing and solving real engineering design problems was due primarily to the learning experiences he had had in the Sooner City program.

6. Remaining Work

The remaining evaluation work can be grouped into four categories, as described below.

- *Longitudinal tracking*. Because the project was phased in over a period of five years, the first cohort of students to go through an entire Sooner City curriculum has not yet graduated (Spring 2003). Our plan is to eventually interview students who have been on the job for at least one year. Questions will probe how the Sooner City curriculum has prepared them to handle design work, as well as look for ways to modify the curriculum to better meet their needs.

- *Capstone evaluation*. Senior capstone design projects, which all civil engineering majors must undertake, are selected to force students to bring together design skills they have learned during their undergraduate studies. Capstone projects are developed by practicing engineers and thus represent "real world" applications. We have filmed the final capstone presentations since 1995. Our plan is to review the films and the final reports from past years, and then, using a scoring system developed by a faculty panel, evaluate each year's projects. By comparing the capstone work of each group and the total number Sooner City courses taken by each group we can obtain a measure of the project's ability to teach design to the students.

- *Employer interviews.* Starting in Summer 2003, we will interview employers who have hired at least 4 or 5 CEES graduates since 1996. We will ask them to discern the design skills and ability to work in teams of students who graduated from the Sooner City curriculum vs. those who did not graduate from the curriculum. Feedback will also be used to modify the program.

- *CEES seminar*. One problem that has surfaced as we have implemented cross-course integration of projects (e.g., a soil mechanics class designing an earth dam must interface with a water resources class who is designing the reservoir for water supply) is that the students from the two courses have difficulty finding a common meeting time. Another problem is finding time to assemble students enrolled in Sooner City courses in order to administer questionnaires and diagnostic tests, such as RATs and CATs. Thus, we have revised our curriculum to include a 1-hour seminar course in which all CEES students must enroll. Pending Regent's approval, we will start offering the seminar in Fall 2003.

7. Closing Comments

After five years, qualitative evaluation metrics to date indicate that the Sooner City Project is meeting its goal of providing students with skills that they were not getting as well, or at all, in the "traditional" curriculum, viz, real-world design experience at all levels, exposure to the integrated nature of the civil engineering discipline, the ability to approach and self-assess open-ended problems with a measure of confidence, effective communication techniques, and the ability to function as both a team member and a team leader. As we continue to collect evaluation data and compare it to the "control" group of students, we hope to better quantify the gains in student performance noted in this manuscript. While we are pleased with the current status of the project, we are using evaluation feedback to refine procedures that will further enhance the quality of the educational experience, to which the project team is committed.

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