Report on the Sooner City Workshop 2000 on Integrated Design[a]

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Abstract

Sooner City, a curriculum reform project undertaken by the School of Civil Engineering and Environmental Science at the University of Oklahoma, seeks to thread a common design project (developing a city's infrastructure) throughout the undergraduate curriculum, starting in the freshman year. The project, begun in 1996, is supported by the University of Oklahoma and the National Science Foundation, most recently through its Action Agenda program. Sooner City has received local and national recognition, including most recently, two Oklahoma Regents' Awards for outstanding faculty innovation. In summer 2000, a workshop was held to report on the project's status and to solicit information from other faculty about teaching design and how to make it more portable to their institutions. The workshop, a series of topical lectures followed by breakout sections, was attended by 24 faculty from a wide-variety of public and private institutions. This paper summarizes major findings from the workshop, particularly as it relates to those wishing to pursue an integrated design project throughout their curriculum.

1. Background

Evaluations of existing undergraduate engineering programs continually cite three weaknesses: graduates lack technical literacy; graduates lack oral and written communication skills; and graduates lack design experience[1-5]. To address these weaknesses, the School of Civil Engineering and Environmental Science (CEES) at the University of Oklahoma, is proposing a systemic reform initiative that incorporates four themes throughout the curriculum. First, the centerpiece of the initiative is a common design project, entitled "Sooner City," that is introduced during the freshman year and continues for the entire curriculum. Design tasks range from population estimates to the water supply system. A common design project unifies the curriculum and allows material learned in early courses to carry forward. Another advantage is that students will have a professional design portfolio that can be presented to prospective employers. Second, the design project is taught using the just-in-time learning paradigm. By focusing on real-world applications up front, students are interested and motivated to learn. Third, courses are being restructured to incorporate collaborative learning and group presentations, which enhances the students' interpersonal and communication skills. Fourth, starting in Fall 1998, all incoming engineering freshman at OU must have a laptop computer with wireless communication technology so that each classroom becomes a networked

a. This is an abridged version of the full report. The complete document, including visual aids from invited speakers, can be found on the web at: www.soonercity.ou.edu.

computer lab[6]. Taken together, we anticipate the efforts will produce graduates who are self-disciplined, responsible, computer literate, and who can communicate effectively with fellow engineers, management, and the public. The new curriculum can serve as a template for other reform efforts around the country, both in civil engineering and in other engineering disciplines. A complete description of the concept is given in the paper by Kolar et al.[7]; the web site can be found at the following URL: www.soonercity.ou.edu.

2. Workshop Description

The objectives of the workshop were twofold. First, Sooner City project information and materials (including early assessment results) were disseminated. Second, the workshop was used to gather input about best practices in teaching engineering design and portability, input that is being used to guide future development of this long-term project. Consequently, workshop sessions consisted of introductory remarks by Sooner City participants or invited speakers, followed by breakout sessions with panel reports. Discussion in the breakout sessions was guided by a set of questions provided by the speakers. The five sessions for the workshop are shown in Table 1, which are

Table 1: Workshop Sessions

Session Number	Theme
I	Pedagogical Issues
II	Design Within and Between Courses
III	Evaluation
IV	Problem Issues with Integrated Design Projects
V	Use of Multimedia in Sooner City

described in subsequent sections. Invited speakers were interspersed throughout the workshop; Table 2 lists the topic of their presentations.

Table 2: Invited Speakers

Speaker	Position	Topic
Dr. Karl Smith, Univ. of Minnesota	Morse-Alumni Distinguished Prof. of CE	On the Role of Collaborative Learning in Design
Ms. Donna Shirley, Univ. of Oklahoma	Asst. Dean Engr., former JPL Program Director	Managing Creativity/Design
Dr. Ronald Sack, Univ. of Nevada-Las Vegas	Dean of Engr. and former NSF Director of CMS	NSF Perspective on Integrated Design
Dr. Bruce Kramer, NSF	Acting Director of NSF Engr. Educ. and Centers	The Future of Engineering Education
Dr. Rafael Bras, MIT	Head of Civil and Envir. Engr	Recommendations of the New Millennium Colloquium on the Future of Civil and Envir. Engr.

Twenty-four participants from across the country attended the workshop, representing a wide-variety of institutions (public vs. private and large vs. small). Participants and their affiliations are shown in the Appendix in Table 1.

3. Session I - Pedagogical Issues

As faculty members and colleges of engineering attempt to improve the quality of their courses and curricula, they will need a conceptual framework to guide this very important effort. This framework will need to be one that meets two criteria. First, it must be capable of identifying the essential tasks of course and curricular design. Second, the framework should offer guidance in terms of how to generate good responses to these key tasks and questions. In this session, an Integrated Model of Instructional Design that seems to meet both these requirements was presented and discussed.

An Integrated Model of Instructional Design

The basic components of this model are shown in Figure 1. The rectangular figure refers to information that needs to be gathered at the beginning of the design process. The three ellipses in this diagram all represent major kinds of decisions the teacher/administrator must make about the goals of the course/curriculum, the types of feedback and assessment to be used, and the forms of teaching/learning activities to be used. These four components, taken together, indicate the key questions that must be addressed in any systematic form of instructional design: What Situational Factors affect the design of this instructional program?; What are the Learning Goals of the course or curriculum?; What kinds of Feedback and Assessment will be used?; What Teaching/Learning Activities will be used?

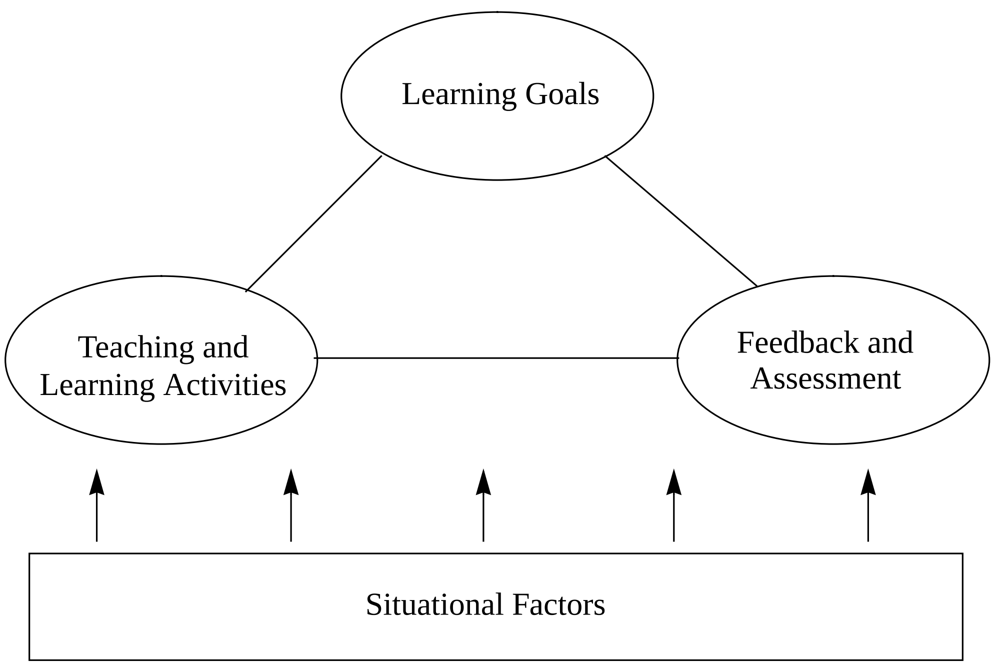

Figure 1. An Integrated Model of Instructional Design

Situational Factors. The first component, "Situational Factors," refers to information that needs to be gathered about the students, the teacher, the subject, and the general context of the learning situation. For example, what prior experiences, knowledge, and attitudes do the students have toward the subject?

What is the teacher's attitude toward the subject and the students? Is the subject one that is fairly stable, or are there important changes or controversies occurring within this field of study? In terms of the general context, what does society or the profession expect students who have had this course to know or be able to do?

Learning Goals. After information about the situational factors has been gathered, the design process starts by identifying what the teacher wants students to get out of the course or curriculum, i.e., the learning goals. The answer to this "What" question of instruction has two dimensions. Most teachers think of content when they ponder the question of what they want students to learn. And this is an important part of the answer. Engineering professors must select content that will be important in the students' future work as engineers. But unless the goals also reflect attention to the kinds of learning that are achieved in relation to that content, the educational results will still be a deficient learning experience. What kind of language and concepts can engineering professors use to construct a worthwhile set of learning goals for a curriculum? They can be cast into six categories, which include the kinds of learning goals contained in the new ABET 2000 accreditation list (a-k), plus some additional ones that seem important for future engineers. They are: foundation knowledge, application, integration, human dimension, valuing, and learning how to learn.

Foundational knowledge refers to the basic "understand and remember" kinds of learning. Application learning is what happens when students learn to think about the content, develop other important skills, and/or learn how to manage complex projects. Integration means combining information from inter-disciplinary sources to produce a complete whole. Human dimension of engineering refers to any educational experience in which students learn about and perhaps change their sense of their own *self*, and in which they learn how to understand and interact with *others* more effectively. Valuing refers to students' interests and values. Learning how to learn can have three distinct meanings: learning how to be a better student; learning how to ask and answer questions; learning how to become a self-directed learner.

Feedback and Assessment. Once a teacher has a clear sense of the significant learning goals for a learning program, the next step is to ask what the students would need to do to convince the teacher that these learning goals have been achieved. This is the feedback and assessment question. The session introduced the idea of educative assessment, which has three components: self-assessment, "FIDeLity" (Frequent, Immediate, and Discriminating) feedback, and forward-looking assessment (replicates authentic kinds of work students will see in the "real" world.)

Teaching and Learning Activities. After the teacher has created good ideas for feedback and assessment, the next and final step is to create learning activities that will allow students to achieve the goals and to perform well at assessment time. This will involve the use of active learning, rather than just passive. In courses that are highly passive, the students' time is spent primarily in the form of receiving information and ideas, by listening to lectures and doing assigned readings. Active learning requires that students have some kind of "Doing" or "Observing" experience and have multiple opportunities to engage in "Reflective Dialogue." Students may engage in dialogue with themselves, in the form of reflective writing, or in dialogue with others. The dialogue may be about the subject of the course (e.g., "What is the correct understanding of this concept or topic?") or about the learning process (e.g., "What am I learning? How do I learn best? What else do I need to learn?") The strategy for achieving a high level of active learning, then, is to ensure that students have (a) good ways of getting information and ideas, (b) significant doing and/or observing experiences, and (c) opportunities to engage in reflective dialogue. In Sooner City, the students get information and ideas in the normal ways: lectures, readings, and in some cases via course-based web sites. In some of the projects, they also have access to real, original data. Each design task also represents a good example of a simulated doing experience. And finally, students are given periodic opportunities to reflect and write about their learning experience.

The Sooner City Project and Good Instructional Design.

According to the model described above, a well-designed learning experience is one in which each of the four design components are done well and all four are connected or integrated. A careful needs assessment should be conducted to identify important situational factors. The learning goals need to be formulated in a way that reflects higher level learning. The feedback and assessment activities should reflect educative assessment, and the teaching/learning activities should be characterized by active learning. The Sooner City Project meets all these criteria for good instructional design.

Exceptional learning experiences have two features that distinguish them from other ordinary or even "good" courses and curricula. These two features are "rich learning experiences" and "in-depth reflective dialogue." A rich learning experience is one in which students can acquire multiple kinds of learning. In the Sooner City Project, the specific course projects, which occur in all four years of the undergraduate program, provide students with rich learning experiences. The students develop strong design capabilities, enhance their communication skills, learn about themselves and how to work with others, how to integrate different aspects of engineering, how to learn new material on their own, etc. The second special feature is having opportunities for in-depth reflection on one's own learning experiences. The introduction and use of learning portfolios will accomplish this. Learning portfolios are narrative statements written by students about their learning experiences, viz, what they have done, what they have learned, a honest assessment of themselves in terms of the multiple competencies desired, in this case, for future work in engineering, and an identification of what they need to learn next to further their professional development as engineers and how they plan to learn that. The portfolios also include appendices of materials that substantiate and illustrate the student's work. These portfolios accomplish two important tasks simultaneously: They prompt the student to engage in reflection on their work as "learning engineers;" and they provide an occasion for in-depth self-assessment. Both tasks are valuable skills and habits for the engineer of tomorrow.

4. Session II - Design Within and Between Courses

One of the primary advantages of the Sooner City paradigm is that it can fit into the "traditional" civil engineering curriculum without major revisions. Rather, courses need only dedicate their design project/case study to a particular infrastructure element of Sooner City. This is "design within a course." Participants in this session were able to generate a wide variety of tasks for each engineering course in the traditional curriculum; the complete list is available on the web, but examples include sizing a water supply reservoir, water distribution systems, an earth dam, transportation corridors, population estimates, building foundations, various steel and concrete structures, and floodplain delineation.

However, if these individual design tasks are not presented as part of a larger whole (i.e., the entire city infrastructure), then little is gained over the traditional curriculum. Thus, the real value comes in identifying linkages between design tasks so that students experience first-hand that most complex design projects span several disciplines, i.e., the complete design can only be realized by interfacing with other disciplines. As for the appropriate model, the participants recognized that not all students progress through a curriculum in the same manner, so tight coupling of courses (e.g., requiring students to co-enroll in two courses that will be working together on a common project) is generally not feasible. A more workable model emerged, viz, one where students in separate courses work on a common project, but each acts as an independent "consulting firm" that supplies information as needed. This model does require faculty to coordinate their syllabi so that information is received in a timely manner, but it does not require student co-enrollment. As a specific example, we discussed the design of a water supply reservoir for Sooner City and looked at coordinating a soil mechanics class (the geotechnical "consultants") with a water resources class (the hydraulic "consultants"). For the project, the water resources group estimates water demands and then uses hydrologic principles to size the reservoir (considering wave height, etc.), including the yearly fluctuations in water level. This information is needed by the geotech group to set the height of the dam, which determines the cross-section. From there, the geotech group designs the earth dam and estimates seepage, which is then passed back to the water resources group so that they can check their assumptions about losses and see if the hydrologic balance needs to be recalculated. Besides making students aware of how their work affects the other discipline, the passing of information back and forth also demonstrates the nonlinear nature of complex design, wherein assumptions have to be made, a solution found, and then assumptions re-checked after a more exact analysis.

While participants in this session acknowledged the benefit of design between courses, they realized that not all projects might lend themselves to the degree of interaction described in the paragraph above. In these cases it was concluded that, basically, any activity that requires students to think beyond the bounds of their current class, even if it is just guest lectures by other faculty, will offer them the opportunity to see their design as part of the "big picture"

5. Session III - Evaluation

The Sooner City Project's Evaluation Plan was presented and the status of the implementation was discussed (see reference 7 for a complete description of the plan). Also, we presented results obtained through various evaluation instruments used in a number of different courses. During this presentation, we explained the Sooner City Project Team's collective definition of the design process as one that consists of the following items:

- Conceptualizing the problem and synthesizing data and requirements
- Making good assumptions
- Finding data/information/specifications
- Considering multiple alternatives
- Assessing multiple alternatives
- Considering non-engineering issues (political, ethical, and environmental)
- Creativity
- Using sound analysis procedures and appropriate tools

It was also discussed that it is critical to define what is involved in the design process in order to create evaluation instruments that can assess whether the Sooner City students can design better than the control group (non Sooner City students). The following questions were considered during the breakout session:

1. What is design? What are the criteria for evaluating design? How do we separate a good design from a bad design in a quantifiable and consistent manner, not only in the final year but also throughout the curriculum?
2. What instruments do we use to evaluate design?
3. How do you make sure that the students (good and not so good) take additional design exercises for evaluation seriously?
4. How do we evaluate each individual student's design skills when the students are working and learning in a team setting?
5. How can we measure the impact of a curriculum innovation on a student's ability to design when they leave college and begin work as a practicing engineer?

Key points from the discussion are given below. Although they are grouped according to the question numbers, not all of the points necessarily answer a particular question. Rather, the breakout groups often posed additional questions and pointed out related issues.

Question 1 - What is Design?

- Design is both a process and a product.
- The students should know what are the criteria for evaluating their designs. Alternatively the students and the instructor can define the criteria together.
- Feedback on how well the students did in their design is important. The instructor should present solutions in the form of both the process and the product and provide his/her thoughts on how he/she would have tackled a particular design problem.
- It is good to integrate material from more than one course in a design problem.
- Evaluating creativity in design is difficult.

Question 2 - What Evaluation Instruments Should Be Used?

- Create a 1-hr evaluation course. The students will take RATs (Readiness Assessment Tests that measure retention of past material) and CATs (Comprehensive Application Tests that measure students' ability to handle a complex design task) in this course.
- The students should be given enough time to think about and digest a design problem. One solution is to give the problem one day and then ask the students to do the design the next day.
- Professional engineers from industry should help evaluate the students' designs.
- Evaluating designs only once during the capstone course is not sufficient.

Question 3 - How Do We Make the Students Take the Evaluation Tests Seriously?

- Create a positive environment. Tell them why it is important for the Sooner City Project that they take these exams seriously.

- Assign a grade either in a particular course or through the 1-hr evaluation course mentioned above.
- Make the RATs and CATs a prerequisite for subsequent courses.
- Put CAT designs in students' learning portfolios.

Question 4 - How to Evaluate Individual Performance vs. Team Efforts?

- Each student can be asked to provide what his or her contribution is to a group project.
- Request each student to maintain a time sheet with tasks and hours spent on those tasks.
- Conduct exit interviews after a group project to find out who did what.
- Work as a team but provide individual reports.
- Evaluate the work of another team member.
- During oral presentations each student in a group is asked to present another group member's work.
- Each student in a group is asked to write individual summaries of the entire project.

Question 5 - How Do We Evaluate the Impact After College?

At Graduation:

- Compare performance on National competitions, such as the ASCE Concrete Canoe competition.
- Employment success and starting salaries.
- Compare a student's performance early in the curriculum to that closer to graduation.
- Compare learning portfolios.

After Graduation:

- Surveys for the graduate and the employer.
- Professional licenses obtained and the number of attempts.
- Success of the graduates through awards and promotions.

6. Session IV - Problem Issues with Integrated Design Projects

Discussion in this session fell under the guise of one of six general questions. The six questions and selected responses are summarized below.

1. How do we integrate meaningful Sooner City design in freshman and sophomore years? a) Involve freshman and sophomore students in upper level design courses. Require them to help with report writing, data collection, field sampling, data analysis, presentations, AutoCAD work, etc. b) Build a CE introduction to design course that spans the breadth of CE. For example, in this course have the students perform a preliminary conceptualization of a city, e.g., water supply, water treatment, highway layout, land planning, assessment of subsurface integrity. c) Introduce students to design by offering a seminar-type course to freshman and sophomores, or involve freshmen into existing design seminars. d) In lieu of existing AutoCAD and Surveying courses, implement a two-course, six-hour "land management/development" Sooner City course to layout the city; then

AutoCAD and Surveying should be introduced as tools in a 'just-in-time' fashion.

2. How do you get faculty to buy in? a) Old Dominion University (ODU) is one example where faculty buy-in was not a problem. The lesson learned from ODU was that if faculty are presented with the opportunity to improve retention and solve problems that faculty are concerned about, faculty will buy in. Additional recommendations included packaging the reform product for easy implementation by faculty. A web-based clearinghouse for multimedia learning modules and design tasks (with solutions) would greatly improve utilization. b) Administration must embrace and encourage improvement and curriculum reform through promotions and incentives, e.g., salary, course load reduction. Administration also needs to promote and encourage faculty to attend educational workshops and conferences. Encourage alumni advisory council to pressure administration if reluctant. c) Educational research is publishable and fundable, metrics that administrators like to see.

3. What should a student portfolio look like? A student design portfolio should connote a 'portfolio-for-life'. The portfolio could be electronic, should include design drawings, calculations, self-reflections/evaluations, and reports, and it should reflect all courses that the student has taken. Students should have control over presentation and content.

4. How do we craft projects and change the Sooner City parameters while considering non-traditional and transfer students? Begin each year or semester with the "best" design from the previous semester so that only one design is carried forward. Assess the transfer and non-traditional students yearly to see where they are with respect to traditional students. Also, offer a transition seminar series to get them up to speed. Use of groups (and the attendant peer mentoring where group members teach one another) will help bring transfer students up to speed.

5. Should we, and if so how should we, mold cross-course design projects? Tight cross-course integration is not recommended because the same students are not enrolled in the same classes. However, each class can be viewed as a specialty consulting group that shares information related to a common design task (see Section 4). Vertical integration is much more natural where designs and data from previous semesters are carried forward, e.g., wastewater flows are carried forward to a unit process class.

6. How do you keep SC fresh? Maintain a clearinghouse with different data sets. Faculty can also alter design parameters each year, e.g., expected population growth.

7. Session V - Use of Multimedia in Sooner City

To the extent possible, all materials developed for the project are available via standard web browsers with industry-standard plugins (e.g., Flash and Director Shockwave, Adobe Acrobat, Cosmo Player). Materials developed for the project fall into two general categories: traditional web pages and content-rich multimedia modules. Both were demonstrated in this workshop session. At a minimum, each course in the Sooner City curriculum places its syllabus, handouts, exam reviews, etc. on the web. Beyond that, individual instructors are using the web to enhance the learning experience in a variety of ways, including chat rooms/bulletin boards, email broadcasts, on-line quizzes and grading, on-line homework submissions, digital photographs/movies of civil engineering projects, forms for student surveys and reflective writing assignments (part of the student's learning portfolio), locating and evaluating and processing on-line data, and virtual experiments.

Multimedia modules are customized learning tools that take full advantage of the technology (animations, sound, interactivity) to provide the students with a rich learning experience (see Section 3). Even if the students do not have all of the tools for a complete design (particularly a concern with lower division courses), multimedia can provide them with a sense of engineering by "hiding" complex equations behind the scenes. Note that we are not advocating use of software as a "black box" - students will learn the theory before they graduate. Rather, we use the multimedia tools to teach the students about the design *process*. It has been our experience that students are comfortable with equations and theories, but are very uncomfortable with the open-ended nature of design where they have to make assumptions and evaluate multiple solutions. Thus, the modules allow students to practice meaningful design earlier in the curriculum.

Typically, the modules contain a description of the theory and the governing equations, complemented with pictures and animations. Following that is an interactive learning tool (as shown in Figure 2 below) wherein the students can vary parameters and material properties (via dialogue

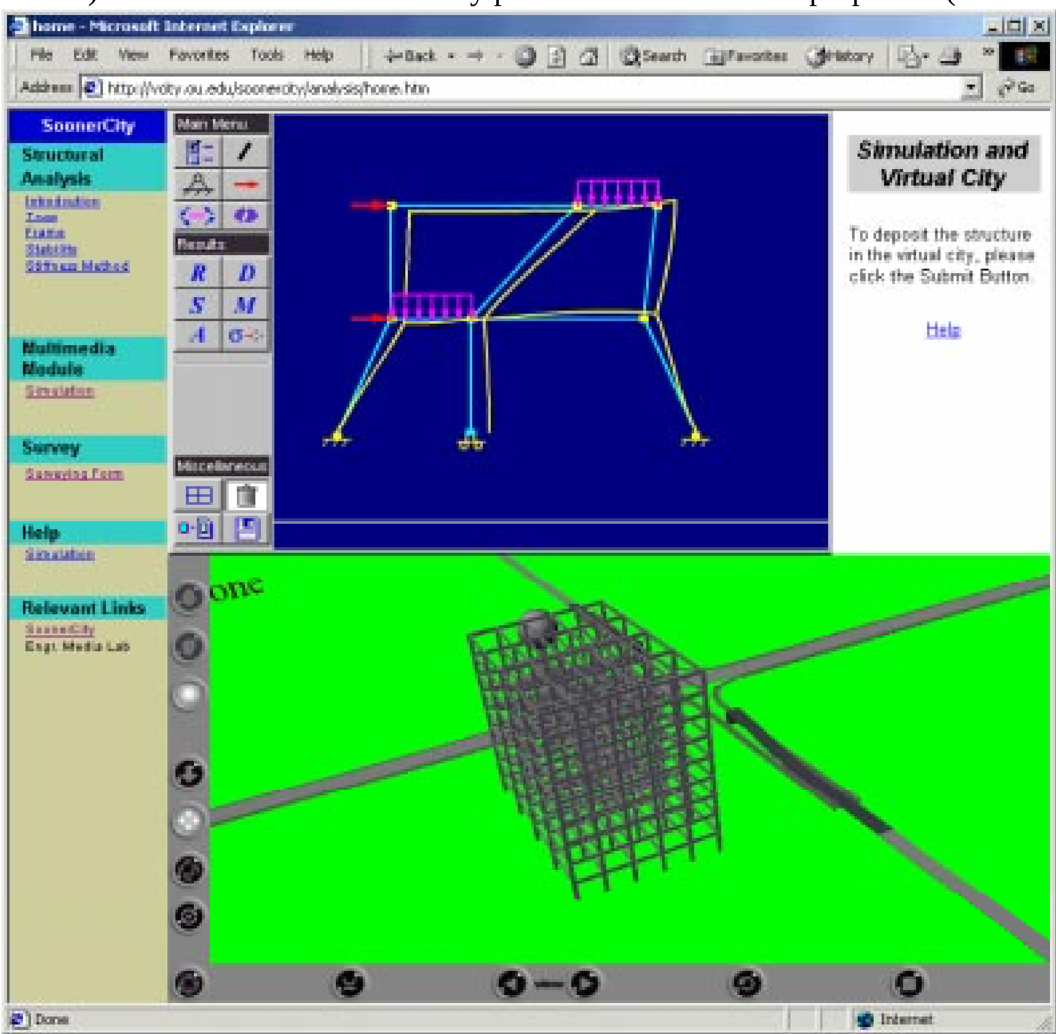

Figure 2. Structural analysis module (upper panel) and the placement of a steel frame in the student's virtual world (lower panel).

boxes or slider/radio buttons) and then observe, through high quality graphics and animations, the impact of their choices on the design. To date, eight modules, as shown in Table 3, have been developed. In that each module is concerned with some element of the total Sooner City design, they also contain a program that creates a VRML (virtual reality modeling language for the web) object that is placed in their Sooner City, thus allowing the students to develop their own virtual city (see the lower panel in Figure 2). Once the object(s) are placed, the students can navigate through their virtual world via a VRML player that operates much like a video game.

Table 3: Multimedia Modules for Sooner City

Module Name	Purpose
Concrete	Design of reinforced concrete beams by LRFD methods
Structural Analysis	2D/3D frame and truss analysis, including stresses and influence lines
Foundations	Footing design
Macromeritics	Concrete mix design/testing
Soil Mechanics	Consolidation
Steel Buildings	Steel frame and connection design
Survey	Topographic mapping and sources of errors
Traffic	Impact of number of lanes and entrance ramp geometry on the level of service

8. Workshop Evaluation

Each participant was provided a survey at the beginning of the workshop and was asked to complete it by the last day. All but one participant did complete the survey, some with very extended comments. The following highlights some of the responses.

Participants evaluated the overall effectiveness of the workshop by answering the following question: *To what degree did you gain new and helpful ideas on how to integrate design into the undergraduate curriculum at your institution?* Of the 23 responses, 65% said the workshop generated lots of new ideas, 35% said a few ideas were generated, and 0% said no new ideas. Written comments indicated that many of the participants intended to try and implement some or all of the concepts at their home institutions.

Another section of the questionnaire asked participants to rate each session with respect to the introductory remarks (by Sooner City personnel or invited speakers) for the session and the quality of the discussion during the breakout sessions. Table 4 below summarizes the ratings, along with some of the written comments.

Table 4: Summary of Session Evaluations

Session	Introductory Remarks[a]	Breakout Discussions[a]	Comments
I	3	3	Helpful ideas; Great historical context; The components of the active learning process were very helpful; Good general discussions.
II	3	2	Would like more details; Not much discussion on cross-course integration; Specific cases were helpful; Session diverged to problem issues.
III	3	3	Great assessment plan; Good source of information about what has been done; Difficult issues.
IV	2.8	3	Restated questions on the breakout sheet; Provided a lot of discussion; Best discussion, idea generation.
V	3	2.5	Could use more time; Sooner City is too “cartoonish”; This session kind of lost me; Too many topics for the time.

a. Ratings are based on a 4 point scale with 4 being very good and 1 being of limited value. The number shown represents the average of the 23 respondents.

9. Closing Comments

Workshop evaluations and interactions with participants lead the authors to believe that the workshop was a success. Participants attended because they felt that there was a need for more design in the undergraduate curriculum and that the Sooner City model might be appropriate for their institution. They raised a multitude of issues, some of which had been considered or encountered by the project team. Collectively, we were able to generate solutions to many of these issues. Their interest and energy were both encouraging and invigorating. We were left with a greater level of enthusiasm and optimism about the portability of the Sooner City concept. A number of participants are currently “trying out” the concept with various degrees of implementation. Feedback from their experiences will help guide future development of the project and future workshops (the next one is scheduled for either Fall 2002 or Summer 2003).

10. Acknowledgments

Support for Sooner City is provided, in part, by funds from the National Science Foundation (Course and Curriculum Development, Award # DUE9652973 and Action Agenda for Systemic Engineering Education Reform, Award # EEC9872505), the University of Oklahoma’s Office of Provost and Office of Vice President for Research, and the School of Civil Engineering and Environmental Science.

11. Appendix

Table 5: Workshop Participants

Name	Institution	Position
Max Anderson	Univ. of Wisconsin-Platteville	Prof. & Chair of Civil Engr.
Cheryl Ann Blain	Naval Research Lab, Stennis Space Center	Oceanographer
Chris Cox	University of Tennessee	Ass. Prof. of Civil/Env. Engr.
Norman Dennis	University of Arkansas	Ass. Prof. of Civil Engr.
William Drewry	Old Dominion University	Prof. of Civil and Env. Engr.
Jess Everett	Rowan University	Ass. Prof. of Civil/Env. Engr.
Jon Fricker	Purdue University	Prof. of Civil Engr.
Adrian Hanson	New Mexico State University	Ass. Prof. of Civil/Ag/Geol. Engr.
Salah Keshawarz	University of Hartford	Ass. Prof. of Civil/Env. Engr.
Wayne Lee	University of Rhode Island	Prof. of Civil/Env. Engr.
Claire McKnight	City College of New York	Ass. Prof. of Civil Engr.
Louay Mohammad	Louisiana State University	Ass. Prof. of Civil/Env. Engr.
Jacob Najjar	Kansas State University	Ass. Prof. of Civil Engr.
John Niklaus	Tulane University	Prof. Civil Engr.
Paul Palazolo	University of Memphis	Asst. Dean of Engr.
Anna Phillips	University of Memphis	Director of Tech. Comm.
Mihail Popescu	Illinois Institute of Technology	Visiting Prof. of Civil/Arch. Engr.
Subby Rajan	Arizona State University	Prof. of Civil/Env. Engr.
Wane Schneiter	Virginia Military Institute	Prof. of Civil Engr.
Sunil Sharma	University of Idaho	Ass. Prof. of Civil Engr.
Ben Stuart	Ohio University	Asst. Prof. of Civil/Chem. Engr.
Vivek Tandon	University of Texas at El Paso	Asst. Prof. of Civil Engr.
Bruce Tschantz	University of Tennessee	Prof. of Civil Engr.
Manoochehr Zoghi	University of Dayton	Ass. Prof. & Director of Civil Engr.

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13. Biographical Information

L. DEE FINK

Dr. Fink received his Ph.D. in Geography from the U. of Chicago in 1976. He currently serves as Director of the Instructional Development Program at the U. of Oklahoma. Scholarly interests include designing learning experiences, higher-level learning, integrated course design, evaluating college teaching, instructional consulting, and faculty development. He received the Outstanding Faculty Award from the College of Liberal Studies in 1992.

KURT GRAMOLL

Dr. Gramoll is the Hughes Centennial Professor of Engineering and Director of the Engineering Media Lab. He received his B.S.C.E. and M.S.M.E. from the U. of Utah and his Ph.D. in Engr. Science and Mechanics from Virginia Tech. He has developed and published CDs and web-based sites for engineering education, K-12 instruction, and training in industry. He has started two multimedia companies to develop and distribute technical electronic media.

ROBERT C. KNOX

Dr. Knox is the Director of the School of Civil Engineering and Environmental Science and John A. Myers Professor at the U. of Oklahoma. Research interests include subsurface transport and fate, ground water remediation, impacts of petroleum hydrocarbons and oil field brines. He has coordinated CEES’ practitioner-driven capstone courses. He received the 1996 ASEE Fred Merryfield Design Award and the 2000 NSPE Engineering Education Excellence Award.

RANDALL L. KOLAR

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