

**Evaluation Report:
Virginia Tech SUCCEED Projects, Years 6-10**

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Related Evaluation Web Site: <http://www.edtech.vt.edu/succeed/>

EXECUTIVE SUMMARY.....	3
PURPOSE.....	5
AUDIENCE.....	5
DECISIONS INFLUENCED BY THE EVALUATION.....	5
QUESTIONS ADDRESSED.....	5
ANALYSIS.....	6
PROCEDURES.....	6
FINDINGS.....	7
CONTEXT (C).....	9
Needs.....	9
Curricular Issues.....	10
Teaching Environment.....	11
Time.....	12
INPUTS (I).....	13
Administrative Support and Leadership.....	13
Industry Support.....	13
Student Assistance.....	14
Funding.....	14
PROCESSES (P).....	15
Collaboration.....	15
Iterative Modifications.....	16
Pedagogy.....	17
PRODUCTS (P).....	18
Changes in Teaching Practice.....	18
Lessons Learned, Project Strategies.....	21
Student Outcomes.....	21
Leverage.....	23
Changed Industry Impressions.....	24
Dissemination Activity.....	24
LIMITATIONS AND RECOMMENDATIONS.....	24
REFERENCES.....	26
APPENDICES.....	27
APPENDIX A: SEMI-STRUCTURED INTERVIEW PROTOCOL.....	27
APPENDIX B, SUMMARY OF PROJECTS ACROSS FOUR FOCUS AREAS.....	28
APPENDIX C: MACRO AND MICRO-LEVEL CODES.....	33
APPENDIX D: INDIVIDUAL PROJECT SUMMARIES.....	38

Executive Summary

This summative evaluation examined 28 faculty-led projects in the College of Engineering at Virginia Tech that were funded by the NSF SUCCEED initiative. Faculty interview data and some project documentation were used to describe trends across all projects. Interview comments were coded and sorted according to the CIPP evaluation framework (Stufflebeam, Foley, Gephart, Guba, Hammond, Merriman, & Provus, 1971; Stufflebeam & Shrinkfield, 1985) to describe critical contextual factors (C), project inputs (I), project processes (P), and project outcomes or products (P).

Four primary contextual factors (C) were evident from faculty comments: the *need* to address a changing skill set and accreditation standards, the influence of *curriculum* on new course offerings and student interest, the effects of class *size and space* on projects, and the barrier of *time* to working on projects. Despite the description of numerous project inputs (I), the four most commonly cited inputs to support SUCCEED projects included: *administrative* support and leadership, *industry* support and partnership, *student* assistance, and *funding*. The three most common project processes (P) included: different types of faculty *collaboration*, iterative *reflection and modification* of project strategies, and the integration of new *pedagogical* practices in the classroom. Both real and anecdotal evidence suggested project outcomes or products (P) were also substantial. Six products of SUCCEED at Virginia Tech included: *changed teaching practices* by faculty; faculty *lessons learned* from classroom experimentation; *student gains* in knowledge, skill, and motivation; *leverage* for additional projects on and off-campus; *increased impressions* of Virginia Tech engineering graduates by industry; and national *dissemination* of SUCCEED projects. Additional research is recommended to confirm the existence of these products and to more precisely clarify the specific inputs or processes that led to their emergence.

The NSF-funded SUCCEED program was based in part on evaluation studies conducted by NSF that reported engineering classes were teacher-centered, rather than learner-centered.

“NSF felt we should focus on improving engineering education, and there are various elements including communication skills ... team work ... early design that should be integrated into the curriculum. I think it’s generally accepted in the engineering education community that the pendulum has swung too far towards the theoretical and we need to get back to the hands-on.”

NSF recommended the development of projects in four focus areas: faculty development, outcomes assessment, student transitions, and technology-based curriculum delivery. Virginia Tech responded to this recommendation, establishing focus area teams to guide the development of projects in these four areas. Projects were funded to address the needs identified by NSF (e.g., early design experiences, hands-on activities in place of theoretical lectures with exams).

For each focus area, objectives were written to define general expectations. Table 1 lists the four focus areas in which faculty-led projects were conducted, along with stated objectives by focus area. Milestones are listed from projects in each focus area to help define the extent to which SUCCEED objectives at Virginia Tech were achieved.

Table 1
Focus Area Objectives and Milestones of Achievement

Focus Area Objectives ¹ :	Milestones ² :
<p><i>Faculty Development</i> Prepare faculty members to implement effective instructional methods and provide continuing support for their implementation.</p>	<p>at least nine faculty development workshops held on such topics as case-based and online instructional methods; over 300 faculty participants across all offerings; seven graduate teaching assistant seminars also sponsored</p>
<p><i>Outcomes Assessment</i> Identify, develop, and test outcomes assessment measures, tools, and methods for critical success factors of engineering graduates.</p>	<p>selected faculty sent to training on outcomes assessment, reported back locally; matrices developed to match program level objectives with A-K outcomes of ABET accrediting body; employer focus groups held to determine additional skills deemed important by industry; Web site and materials developed by writing portfolio program to train others in this assessment process</p>
<p><i>Student Transitions</i> Objective 1: Establish an early engineering identity and expand the first-year transitioning to include explicit learning skill development and inculcate clear expectations. Objective 2: Provide students more access to real-world engineering design experience and engineering practice opportunities. Objective 3: Improve/increase the exposure to engineering design, ethics, and professionalism in introduction to engineering courses.</p>	<p>emerging scholars program (ESP) calculus established with additional one-hour small group sessions held to provide selected students with help and additional problem solving opportunities; ongoing minority Bridge program supported for students to take college courses on-site before actual enrollment seven projects: students participated in virtual corporations, emerging scholars program (ESP) statics, building design with vertical and horizontal integration, infrastructure problem solving with nondestructive testing equipment, biological systems real-world design projects, mechatronics design, and career development opportunities such as mock interviews engineering fundamentals curriculum updated: freshmen participated in hands-on laboratory and hands-on classroom manipulations as part of EF 1015, design experiences integrated further into early problem solving and design and graphics courses; online engineering ethics course developed</p>
<p><i>Technology-Based Curriculum</i> Objective 1: Enhance teacher-student and student-student communication using network-based collaborative environments for academic interaction. Objective 2: Empower faculty to develop electronic media-based instructional content.</p>	<p>engineering advising CD created with faculty and program information, distributed to pre-enrolls, updated to a Web site; multimedia statics CD developed with associated cooperative learning classroom activities; online questions and drills created to support students in gateway courses; multimedia CD created with the assistance of students to document and teach manufacturing processes faculty trained in technology production both on and off-campus; selected faculty provided with technology production assistance to develop such items as self-paced, remedial materials for students and animated segments explaining communication systems</p>

¹ The focus area objectives were taken from the CIT Budget/Task Summary

² The milestones were based on faculty interview data

Evaluation Report: Virginia Tech SUCCEED Projects, Years 6-10

Purpose

The purpose of this evaluation is to summatively describe how Virginia Tech faculty awarded SUCCEED project funds have addressed their stated goals or "work scope." SUCCEED is a NSF-funded coalition of nine southeastern engineering schools dedicated to improving undergraduate engineering education. This evaluation represents an effort to gather local campus data, rather than information from each of the nine SUCCEED schools.

Audience

The primary audience for this evaluation report includes: Dean F. William Stephenson of the Virginia Tech College of Engineering; Dr. Timothy Anderson, Director of SUCCEED at the University of Florida; and Virginia Tech engineering faculty involved in SUCCEED projects. A secondary audience to further benefit from evaluation findings includes: Dr. Terry Wildman, Director of Virginia Tech's Center for Excellence in Undergraduate Teaching (CEUT); and Dr. Tom Wilkinson, Director of Virginia Tech's Institute for Distance and Distributed Learning (IDDL).

Decisions Influenced by the Evaluation

The results of the evaluation describe the effect of SUCCEED project expenditures on undergraduate engineering education at Virginia Tech. Thus, primary audience members will be able to make decisions regarding the continuation, expansion, or possible direction of any new funds to support ongoing or emerging projects. Further, the primary audience will be able to describe results from Virginia Tech projects to help pursue new undergraduate engineering education grants from NSF or other funding agencies. The evaluation also describes lessons learned, best practices, and common enablers or barriers to project success that will help primary and secondary audience members better implement future projects of a similar nature. Additionally, we report recommendations from project leaders that will allow decisions makers to judge the sustainability of appropriate projects.

Questions Addressed

As agreed upon in an evaluation plan written by Kevin Oliver of Educational Technologies and Glenda Scales, Assistant Dean in Engineering, four categories of questions were addressed during this summative evaluation. The four categories were derived from Stufflebeam's decision-based evaluation model entitled CIPP (context, input, process, and product) (Stufflebeam et al., 1971; Stufflebeam & Shrinkfield, 1985). Context questions were posed to faculty project leaders to define the institutional context, identify needs of the target population and opportunities to address those needs, and determine how well project goals and outcomes addressed stated needs. Input questions were posed to faculty to define institutional capabilities as well as project strategies and designs. Process questions were posed to faculty to define deficiencies in project processes or their implementation. Product questions were posed to faculty to define project outcomes and judge their worth. Specific questions that comprised the interview protocol are

listed in Appendix A. To answer the questions, individual interviews were conducted with each Virginia Tech SUCCEED project leader, and products or materials developed for the projects were reviewed.

Analysis

Qualitative case study analysis was utilized to process the evaluation data (Miles & Huberman, 1994). SUCCEED projects in years 6-10 of the program were divided into four focus areas: Faculty Development, Outcomes Assessment, Student Transitions, and Technology-Based Curriculum Delivery (see Appendix B). Twenty-eight separate projects were conducted across the four focus areas. These projects were analyzed collectively as a single, macro case.

First, each interview transcript was transcribed and marked-up to easily locate particular questions and responses. These properly formatted interview documents were then uploaded to the N*Vivo qualitative data analysis program (QSR, 2001). Each interview transcript was read in detail, and codes describing the issues raised were created inductively within N*Vivo. The creation of codes from the ground-up is consistent with a “grounded theory” methodology recommended by Lincoln and Guba (1985). Thirty-eight macro or high-level codes were generated to describe general trends occurring across the projects (see Appendix C).

Second, N*Vivo was used to search for all samples of a given code (e.g., collaboration). These interview segments were re-read for similarities and differences. For example, upon re-reading the macro or high-level code for “collaboration,” it was determined that several types of collaboration actually occurred across the different projects: research, promotion, collegial, professional, networking, evaluating, and developing. This analysis stage could be termed “sub-coding,” or filtering as new codes were generated to describe the lower-level processes taking place. During this stage, codes were also moved around. For example, the “changes in teaching behavior” code was found to be better coded as an “effect” of the SUCCEED projects. The “effects” code was found to be a more inclusive category that also included the “learning” code. Also, the “money” code overlapped with “expenditures,” and really did not have enough content to sustain its own code, so they were combined. The “assistance” code was mostly the need for technology production assistance, and as such was lumped with the “needs” code.

After sub-coding and sorting the original codes, the sub-codes and their related interview segments or clips were classified into one or more of the four pre-conceived categories from the CIPP evaluation framework: contexts, inputs, processes, and products (Stufflebeam et al., 1971). For example, project leaders outlined several types of student outcomes, and these sub-codes were classified under the “products” category of the evaluation framework. Project leaders also defined several types of needs that led to the development of SUCCEED projects, and these sub-codes were classified under the “context” category of the evaluation framework.

To provide a snapshot of each project, individual project synopses were generated with common descriptors: project label and title, personnel involved, monies awarded, stated expenditures of funds, project goals and/or needs, and project activities (see Appendix D).

Procedures

Kevin Oliver arranged and conducted interviews with Siegfried Holzer, Pamela Kurstedt, Bev Watford, Eric Pappas, and Joe Tront, who collectively directed 13 of the 28 projects to be evaluated. Cheryl Peed arranged and conducted initial interviews with Imad Al-Qadi, Jeff

Connor, Mary Cummings, Sam Easterling, Richard Goff, Gene Haugh, Robert Hendricks, Tamara Knott, Jason Lockhart, G.V. Loganathan, Hugh Munson, Tim Pratt, Krishnan Ramu, Will Saunders, Glenda Scales, and Praveen Vijayraghavan, who collectively directed 15 of the 28 projects. Micro cassette tapes containing interviews were delivered to Tammy Stevers for transcription.

Kevin and Cheryl asked all 16 questions in the semi-structured interview protocol to each project leader (see Appendix A). Questions were asked in the same order, and no question was skipped. If a question was not applicable to a specific project, the project director was asked to state so on the audiotape. If a project leader directed more than one project, they were typically interviewed twice or more depending on the number of projects they directed. A few exceptions to this rule were noted for projects with very similar foci.

The interviewers attempted to collect specific examples of project products, artifacts, materials, etc., whenever possible. If materials were not at a project director's disposal during the interview, the interviewers asked where such items could be viewed, and/or took down contact names of individuals who could provide a copy of or access to this evidence.

Kevin Oliver was responsible for the described analysis phase, and the subsequent evaluation report and Web site. A Web site was created with a project page for each of the 28 SUCCEED projects at Virginia Tech. As a qualitative "member check" for accuracy, project leaders were e-mailed and asked to review their specific project page. Project leaders were also requested to send any supporting files they wished to add to their project page. Approximately 10 of 28 project leaders responded to this request. The Web site with project artifacts from selected projects can be accessed online at: <http://www.edtech.vt.edu/succeed/index.html>

Findings

Table 2 summarizes the major findings across the four areas of the evaluation framework: contextual factors, inputs, processes, and products. Following the table, detailed descriptions of the findings are provided from faculty interviews and supporting documents.

Table 2
Summary of Findings in CIPP Evaluation Framework

Prevalent Contextual Factors (C)	
Needs	<ul style="list-style-type: none"> • student acquisition of diverse and new skills, related to NSF and ABET standards • increased focus on student prerequisite knowledge and math in designing new learning environments • follow-up faculty support for workshops and technology production assistance
Curricular Issues	<ul style="list-style-type: none"> • difficult to include new courses in a full curriculum • decreased student interest in non-curriculum courses • difficult to sell and integrate new courses during accreditation periods
Teaching Environment	<ul style="list-style-type: none"> • issues of class size and flexible space
Time	<ul style="list-style-type: none"> • lack of time as a barrier to project participation with additional academic demands • importance of time to develop technology-based materials
Prevalent Inputs (I)	
Administrative Support and Leadership	<ul style="list-style-type: none"> • administrative officials provided participatory, monetary, and moral supports • a few administrators were thought to hinder innovation and project processes
Industry Support	<ul style="list-style-type: none"> • matching support to leverage SUCCEED funds further • willingness to provide time and feedback to the college
Student Assistance	<ul style="list-style-type: none"> • student assistants as key input to SUCCEED projects, performing data collection and analysis, producing teaching materials, supporting classroom teaching and lab activities
Funding	<ul style="list-style-type: none"> • nine general funding categories, such as guest speakers, travel, and wages • cost-sharing to leverage SUCCEED funds further
Prevalent Processes (P)	
Collaboration	<ul style="list-style-type: none"> • seven apparent collaboration categories, including collegial, professional, and research
Iterative Modifications	<ul style="list-style-type: none"> • several project leaders adopted a cycle of reflection and improvement for such items as technology-based materials and teaching practices
Pedagogy	<ul style="list-style-type: none"> • the three most cited pedagogical strategies in SUCCEED projects included hands-on activities, real-world design activities, and cooperative teaming with both vertical and horizontal integration

Prevalent Products (P)	
Changes in Teaching Practice	<ul style="list-style-type: none"> • faculty described changed teaching practices through training, mentorship, and experimentation with new learning environments • many comments indicated the new teaching practices would be institutionalized beyond SUCCEED • a few faculty described a reluctance in their peers to adapt to these changes
Lessons Learned, Project Strategies	<ul style="list-style-type: none"> • related to the iterative modifications process (P), faculty described many lessons learned from their projects, including improved teaching and training practices
Student Outcomes	<ul style="list-style-type: none"> • anecdotal evidence from faculty suggested students acquired numerous gains in knowledge and skill through new teaching practices • emerging scholars program (ESP) small-group tutorial sessions had mixed results for scaffolding learners • hands-on and real-world projects that gave students more control over their own learning were praised for being motivational
Leverage	<ul style="list-style-type: none"> • SUCCEED projects were used to extend or leverage other projects internally in the college and at the university, as well as externally in other universities and commercial markets
Changed Industry Impressions	<ul style="list-style-type: none"> • SUCCEED project leaders indicated graduating students were leaving Virginia Tech with new skills and industry representatives had stated their appreciation for these well trained individuals
Dissemination Activity	<ul style="list-style-type: none"> • Web sites, conference posters and presentations, exhibit booths with take-away CD describing SUCCEED at Virginia Tech, as well as local discussion, were all means of disseminating SUCCEED project results

Context (C)

“Context” represents the first component of the CIPP evaluation framework. Interview questions were developed to identify the needs or pressing issues addressed by SUCCEED projects, and to identify elements of the institutional context that might influence SUCCEED projects. The college’s curriculum and teaching environment were two contextual variables mentioned frequently by faculty project leaders. Faculty also related their concerns with managing time.

Needs

The needs addressed by project leaders at Virginia Tech fit within the four focus area bounds recommended by NSF. Within the bounds of the outcomes and student transitions focus areas, the most common need cited by Virginia Tech project leaders was for students to acquire new and diverse skills to meet the changing requirements of their disciplines. Individual projects attempted to: help students acquire more experience with teamwork, “...increase the level of communication skills required in classes,” “...integrate more writing and communications into classes,” “...increase [students’] mechanical skill level ... and the awareness of how things worked,” address the lack of ethics training in specific departments, and address the increased need for knowledge of digital design in electrical engineering.

Within the bounds of the student transitions and technology-based curriculum delivery focus areas, another common need cited by Virginia Tech project leaders was a lack of student prerequisite skills and difficulty passing math-intensive courses:

“One faculty member mentioned that students that enrolled in his class did not have enough background in order to complete portions of the class ... if they did not have what was needed ... they can go directly to a place ... for remediation, books, online materials, so that they would not have to wait until they enrolled in the class in order to get that support, they could get it ahead of time. ...they need a rapid course that they can take on their own, which will bring them up to speed in these areas.”

Finally, within the bounds of the faculty development and technology-based curriculum development focus areas, a need cited by Virginia Tech faculty members was to provide follow-up support for workshops and technology production assistance for faculty.

“Workshops ... get the faculty members salivating, and then once they do, they need some help actually getting to the food so to speak, and they need someone to do the production....”

Curricular Issues

Curriculum was mentioned as a barrier to starting and continuing SUCCEED projects for three separate reasons. First, three project leaders mentioned the curriculum was too full to add any new content, courses, or programs:

“I could never use this program effectively ... because the curriculum is too full of stuff and so the only thing you can do primarily is to teach towards the common examinations, it’s unfortunate.”

“...because of ... the many different courses in all the departments, they don't like to add more courses...”

Second, three project leaders indicated students had less interest in many SUCCEED courses that were not in the curriculum yet, and did not count as credits toward their degree programs:

“The biggest obstacle right now is curriculum, I think our students have ... to take design project courses already, and so when they look at this as just an elective, which is the only real place they can use it, as another significant design project experience, I think there is some reluctance.”

Finally, there was split opinion on the effect of ABET. Two project leaders believed the upcoming ABET accreditation of the college kept their SUCCEED programs out of the curriculum. They believed decision makers were not willing to risk experimental or untested courses in the curriculum prior to an accreditation visit.

“[The course] is not part of the curriculum for a very simple reason, our department is going through ABET this coming fall, and the past two years or so when I proposed it, they were thinking that we should deal with these things after ABET, so that's the whole thing.”

While ABET was described as a barrier to implementing two courses, additional faculty described ABET standards as an impetus for change which led to the development or acceptance of their projects.

“It is the only course which satisfies all the requirements of ABET, nothing else satisfies it and ABET makes it a condition that students have to have experience outside of [class], and this is the only project that they get it...”

“ABET requires that students have the experience in setting up experiments, not just running them, but to set them up, and so this is what I do in using this gravity flow thing that I developed for the class....”

“It’s primarily targeting transfer students that come to Virginia Tech who have not had prior ethics courses or any course content because that is an ABET requirement.”

It should also be noted that three SUCCEED projects in the outcomes assessment focus area were specifically designed to help the college address and meet ABET accreditation requirements:

“...come up with really good instruments to identify in each degree program ... program objectives ... how did those program objectives map onto ABET A-K outcomes and ... where in the curriculum were those A-K outcomes achieved by course. ...a series of matrices that sort of matched all of those different objectives and ensured that we had all of them covered.”

Teaching Environment

Another contextual factor that was mentioned frequently by project leaders was that of teaching environment. Seven project leaders indicated the size of their classes made it difficult to adopt certain teaching strategies, or to provide students with proper lab and human resources.

“...this grew from a student body of 50 students to 180 students in less than a year or so, and we could not have enough resources to individually monitor and assist the students at that point, and our teams do not exceed more than four or five students, and we learn this is something that requires enormous man power providing this program....”

“The negatives may be that it’s going to get too many people interested ... too much of a good thing because you know we have only got limited resources to handle so many students because it’s a lab intensive course...”

“I don’t think we had the resources to do it, we were looking at several graduate students and quite a bit of faculty time to support 1,200 freshmen going through this [lab] every semester.”

Faculty did not offer solutions to the class size problem, although a few mentioned creating simulated labs for delivery on CD-Rom or via the Web to free up lab space. Others simply indicated additional space and teaching assistants would be necessary to provide additional lab experiences to populations not traditionally served.

Three project leaders mentioned the need to develop flexible spaces for a mix of lab and classroom activity. Two leaders indicated such spaces had been developed for student design projects during the course of the SUCCEED program at Virginia Tech:

“And the space, where to do it initially was a big barrier, we didn’t have any space to do it in so we did it in the classroom and again taking apart a Briggs and Stratton engine in the classroom, there is not any oil in them but you have mechanical parts that are still messy so that was an initial barrier, but otherwise once we got the space refurbished ... the complaining has pretty much all disappeared....”

Time

Five project leaders indicated their lack of time was a barrier to managing SUCCEED projects. Due to research and teaching obligations, as well as tenure-track pressures, project leaders indicated the need for a proactive faculty leader who was motivated as a teacher.

“Many faculty come and go with these projects ... not a stable group of faculty staying with this project ... we will probably need about ... 10 to 20, and we probably have about four or five ... we do not have really the way to attract and keep these faculty unless there is some support ... release time, but everybody is a volunteer in this project, and they have all the research programs ... they are working on also.”

“I mean if you have a professor who is also busy in other courses and research, the professor cannot be arranging for these kind of small logistics that appear small, but believe me its so time consuming.”

Four project leaders who developed technology-based materials also cited the need for time to develop their Web sites, multimedia programs, and distance courses. Rapid change in technology was both a barrier to upgrading and maintaining existing course materials, as well as an improvement in production processes to facilitate faster development.

It should be noted that three project leaders praised the extra time that SUCCEED grants provided them to develop new courses and materials.

“I think the funding is always an impetus to spend the time to do it because in my case it was an extra course the time I did it....”

“I have now written two books ... this year. Otherwise, it had been waiting on my desk for 15 years, I had never completed it, but because of this I was able to push it.”

Inputs (I)

The second component of the CIPP evaluation framework is “input.” Inputs represent the items faculty need to meet their project goals. Faculty project leaders indicated three types of support were most critical for their SUCCEED projects: administrative support and leadership, industry support, and student support. In addition to the roles of leaders, industry, and students, SUCCEED projects were further supported by funding for such items as wages, travel, equipment, and technology.

Administrative Support and Leadership

One of the principal inputs to SUCCEED at Virginia Tech was administrative support and leadership. Eleven project leaders cited cases of administrative influence on individual projects. Administrators were praised for participatory support: attending scheduled workshops, welcoming participants, and setting an example by their presence. Administrators were praised for monetary support: providing additional funds to leverage and expand on SUCCEED projects. Some department heads were praised for moral support: allowing their faculty to attempt innovative projects and provide some latitude for creative teaching. It should be noted, however, that a few department heads were recognized as not supporting these new teaching initiatives, given their departmental priorities on research and publications.

“...administratively the support was through my boss, who gave us the latitude to attempt this”

“...he took the biggest risk in this program by investing in this program not knowing how it was going to turn out and the sheer determination of him to invest and blindly support this program so that it can blossom. Without his support, I don't think this program would have survived.”

“...if the department had been against doing this it certainly wouldn't have happened... department head was very excited about the fact that we were actually doing it....”

Industry Support

Three student transition project leaders indicated their projects were quite costly, and SUCCEED funds only provided partial funding. These individuals praised the added support of philanthropists and industry for providing funds to establish lab space and facilities:

“We have received a lot of industry support and funding for the lab ... Fritz gave us a quarter of a million dollars to refurbish the space and to develop an endowment for undergraduate assistance. We have also received sizeable money from Lockheed

Martin, material contributions from Briggs and Stratton, from Black and Decker, from Kodak, and General Motors....”

Industry was also involved in providing feedback to Virginia Tech regarding its graduates skills and qualifications. Focus groups were held, and the interest of industry representatives in participating was high: “...we received very good participation. ... a lot of people really wanted to be there.”

Student Assistance

Graduate assistants, and some undergraduate assistants, were common elements in most SUCCEED projects at Virginia Tech. Students were generally praised for performing duties faculty did not have the time to conduct. On a few projects, students assisted with data collection and analysis, and were responsible for producing technology-based teaching materials. More commonly, faculty in nine student transition projects cited the use of graduate assistants to support general classroom teaching and laboratory activities. Graduate assistants were utilized to: monitor classroom communications via Web tools, coordinate field activities, prepare and administer laboratories, and teach.

Funding

The individual project summaries in Appendix D specify how project leaders spent their SUCCEED funds. Overall, funds were spent to provide the following project inputs: guest speaker travel and honorariums (3 projects); faculty travel to conferences or workshops (4 projects); refreshments for on-campus events (3 projects); graduate assistants (12 projects); staff wages for such tasks as conducting focus groups and programming (4 projects); faculty wages (9 projects); lab-type equipment (6 projects); hardware and software for developing teaching materials (8 projects); and meals, lodging, and textbooks for transition program participants (1 project).

Cost sharing was provided by various college departments when SUCCEED funds provided only partial support for a necessary project input. For example, college cost sharing provided supplemental funds for: graduate assistants, faculty travel to external workshops beyond the representatives sent with SUCCEED funds, materials and meals/lodging for program participants, and equipment. Further, the Student Engineers Council at Virginia Tech provided supplemental funds for three student transitions projects to purchase equipment:

“We received support last year from the Student Engineers Council after SUCCEED had supported the development of the projects. We then went to the SEC and said well we have money for development, but we need money for equipment and that is where we received the \$12K last year from the SEC where we have bought already most of the devices that we have used.”

Processes (P)

The third component of the CIPP evaluation framework is “process.” Processes represent the steps taken by faculty to design and implement their projects. Faculty described three primary processes: different types of collaboration, iterative modifications to course designs, and the implementation of new instructional strategies.

Collaboration

A primary theme that ran across all four project focus areas was that of collaboration. Almost all project leaders mentioned some aspect of collaboration. Seven different types of collaboration were cited. Collaborators were utilized to support SUCCEED projects in the following capacities: as researchers, promoters, colleagues, networkers, evaluators, professionals, and developers.

One project leader mentioned a mutual collaboration between the State Council for Higher Education in Virginia (SCHEV) and Virginia Tech’s Student Transition Program (STP) to help conduct research on the best methods for supporting students at risk.

Four project leaders pointed out collaborations with both internal and external agencies to help market and/or promote SUCCEED projects. At the time this report was written, at least two project directors were exploring the possibility of co-sponsoring courses with other universities using the Web. Further, the university’s Center for Excellence in Undergraduate Teaching (CEUT), Faculty Development Institute (FDI), and Career Services Department were each utilized to co-sponsor SUCCEED workshops. As one project director mentioned, co-sponsorship spread out the responsibilities of scheduling speakers and rooms, and also led to better attendance:

“When Career Services was running [seminars] by themselves, attendance was low. When we were running them by ourselves, we would get 10-12 people, but having the seminars with the College of Business, having all three units together advertising and pushing it to students... we actually ran out of room at the etiquette dinner.”

Project leaders themselves also handled marketing. E-mail was by far the most common method to advertise workshops or upcoming events. Word of mouth and personal conversation were also mentioned by a few project leaders to convince other faculty at Virginia Tech to participate in SUCCEED projects.

Five project leaders revealed the collaboration of colleagues as a necessary ingredient for successful projects. Faculty would “kick around various ideas” and “come up with new and interesting ideas” during planning sessions.

“We developed sets of notes that we share amongst, with the group here that teaches that course....”

By far the most popular type of collaboration that took place was that of networking. Seven project leaders cited instances of attending conferences or discussing projects with faculty at other SUCCEED schools. This networking often resulted in the dissemination of best practices or techniques among other faculty at Virginia Tech.

“The assessment group, they would come back and we would all talk about what they did and how they did it and what was it like and what can we learn.”

“We would go to SUCCEED conferences, poster sessions, and of course informal discussion seeking ideas.... Other faculty were extremely helpful, we got a lot of good ideas.”

“I do think though that one of the biggest benefits we had in the SUCCEED project was just what we were able to do here and sharing that, because each of us have our contacts at other universities, we know what our colleagues are doing, and so if we get that and bring it back and share it among our group, we maybe could accomplish the same thing we did with this SUCCEED.”

A few project leaders in the outcomes assessment focus area cited the collaboration of industry representatives who come to career fairs and of former graduates working in industry. These individuals volunteered their time to provide feedback on Virginia Tech students and program areas. In addition to supporting college evaluation efforts, industry professionals were cited by project leaders in the student transitions focus area for their willingness to sponsor real-world design projects.

The final type of collaboration was cited by three project leaders in the technology-based curriculum focus area—developers. Multimedia designers and Web developers were utilized to provide development support for several projects.

Iterative Modifications

A number of SUCCEED project leaders described iterative processes in their work. A cycle of implementation, reflection, and change, was frequently undertaken as faculty attempted to clarify the most appropriate path for their projects. A few project leaders indicated reflecting on and updating technology-based materials such as Web sites and interfaces. As described, one lesson learned was to develop, reflect, and update small units instead of entire course sets:

“In fact probably half of what we did became obsolete. ...we designed too much at the beginning without testing it.... We actually developed ... a few years’ materials ... you should take one unit ideally and immediately begin testing and you learn from that so much that the next one already has improvements.”

Eight different project leaders further described changing their teaching practices and courses in an iterative process over time.

“Every year we change it. ...we are reducing the engineering problem solving and giving it more focus because what we noticed was the discrepancy ... the math grade in the fall semester was getting smaller and smaller, and we think ... that we were giving the kids too much stuff during the summer and they were getting a lot in very little depth, so we needed to go back to reduce the number of materials....”

“...the actual hands-on time was really pushed to the rear of the semester so much that they didn’t have time to absorb it ... and so for the second year we made that adjustment....”

“...it’s an iterative process, you try something and you see how it works, and usually in our division we have 40 sections, a dozen people teaching the same course, so to ramp that up to all those folks is ... a five-step process.”

Pedagogy

As a result of SUCCEED projects, faculty incorporated several new instructional strategies into courses at Virginia Tech. These strategies include: hands-on activities, real-world design projects, and cooperative learning and teamwork that were integrated both vertically among grade levels and horizontally across colleges.

Six project leaders described the design of student hands-on activities, labs, and experiments. Reasons cited for hands-on activities were: to meet changing ABET requirements to provide students with hands-on experiences, to motivate the students with realistic problems, and to help ground student understanding of complex theories and laws through more concrete experiences.

“...that was a goal ... to introduce hands-on experiments so that the students can touch, feel, and see how it really works in an engineering context mixing both math and engineering. ...it does not have to be an abstract mathematical class ... the students can appreciate math ... do the experiment ... see how mathematics can give them what they are looking for and what the symbols mean....”

Three project leaders described the implementation of real-world design projects. Some students would work outside of campus on actual engineering problems, helping local agencies such as the Town of Blacksburg, the Virginia Department of Transportation, environmental bureaus, and individuals. Design projects often stressed communication skills as well, requiring student teams to present plans to a larger group.

“...as far as the real world design projects, we identify projects around the state, mostly local ones. One was a design of a dog kennel. ...a cleanup site... underground water that has been contaminated. ...there was a Vet who had bought a big farm and he wanted to develop an irrigation system for his farm.... The students on the design team did put together a plan for the use of that water and designed an irrigation system ... we had a geology student cooperate on it ... he was thrilled too ... he was interested in underground water movement and they didn’t have anything like design

over there ... he was able to work with these engineers ... he was able to contribute a lot....”

Another common process cutting across numerous SUCCEED projects was that of teamwork and cooperative learning. Some projects involved students in Emerging Scholars Program (ESP) small-group instruction to supplement the regular course. Other projects involved students in team-based designs and group-based inquiry with multimedia simulations.

“...students work in groups and primarily there is hardly any lecturing, it’s teamwork, students teach one another and they learn how to solve problems....”

Four student transition projects integrated teamwork vertically, combining freshmen and sophomores with upper-level students.

“The team will have sophomore, junior, senior, and graduate students. The duties of each one is specified by me, but it has to be teamwork, so the students learn how to work together ... and the other thing is to learn from the other people who are a little more advanced....”

Seven projects integrated teamwork horizontally, combining engineering students with students in other colleges and integrating the subject matter of these related disciplines.

“...there was no need to really separate and put everything in compartments, math, physics, engineering--they all can work together, you can pick a good engineering problem and show all the concepts running through and sometimes I feel probably that’s a better way, because the students get to see why I am learning something in some other area so they can make the connection right away.”

Products (P)

“Product” is the fourth component of the CIPP evaluation framework. Products represent changes, outcomes, or the value-added from SUCCEED projects. Products of SUCCEED at Virginia Tech include: changes in teaching practice by faculty, a better understanding for how to implement teaching strategies and training, anecdotal evidence of improved student skills, the use of projects to leverage the growth of similar or new programs, improved industry impressions of Virginia Tech students, and disseminated findings to educate others.

Changes in Teaching Practice

Ten separate project directors across all four focus areas cited direct evidence of improved teaching practice as a result of SUCCEED projects. Changes in teaching practice stemmed from three primary influences: direct training, mentorship, and classroom experimentation and experience.

“You pick one or two strategies and you implement them slowly. For example, if you have never had group activities ... you try a group activity, disperse it into a lecture

environment. And as you learn, as you become more proficient and more sensitive ... you are sharing control with the students for the first time perhaps ... you have to be secure ... you have to be willing ... to admit that you can't solve all the problems."

Evidence indicates teachers who received direct training on classroom teaching integrated new experiences in their classes:

"...he went to this workshop and came back and accepted responsibility for a new course ... that is based on team based design. Every team that we put together had experiences along those lines, but this one was the most striking because ... he became a leader that had six or seven faculty members ... faculty teams ... student teams, and the whole thing was experimental, and the student evaluations were just superb once the students learned to work in teams."

Evidence also suggests when mentors familiar with assessment or instruction work directly with faculty, changes in teaching practice can take place:

"What has happened here is that over the years I will be team teaching a class with an engineering professor and maybe he/she will take the papers first, you know a lab or something, and then I will get it, and then it will go back to the students. I notice over the years that the engineering faculty members are increasingly grading writing as well as technical accuracy."

Substantial evidence indicates engineering faculty at Virginia Tech gained a new and lasting appreciation for contemporary teaching practices through their work on SUCCEED projects.

"I used to think analytical method was the best, you go to class fully prepared and you transmit the material ... but thinking back on that, now I am changing my opinion because... you put them through this type of hands-on experiments, they have thousands of questions, why it has to be this way, why this particular material behaves this way and so on ... I believe they can learn a whole lot, and I am not convinced we could have done many of these just based upon lecture type method."

"One of the most important things is that it has convinced me that teamwork and teaching is the way to go. I use that in my other classes successfully, I use breaks in my classes, unfortunately I cover less materials, but I am happy with the understanding that the students have ... this course helped me in that aspect to bring it to the other courses too."

"the work leading up to this ... completely changed my outlook on how a class should be taught because I am very definitely a lecturer by nature."

"I learned that the way I learned as a student, which was primarily an analytical method of learning, was not the way most of our students learn..."

Comments from some project leaders suggest early design and hands-on activities have been institutionalized and will continue to take place at Virginia Tech well past the SUCCEED program.

“There were a lot of people who were skeptical about [student-led projects] when we started in engineering, major faculty, and now they have all become strong supporters of this program having seen what it can do to students' learning.”

“There was a lot of initial resistance to taking ‘content’ out of our class to put in these hands-on things that were seen by some as somewhat frivolous and kind of off the path. So we initially [separated the two], said oh here is the lab over here and here is our class, but slowly over the years we started introducing more and more hands-on and early design type activities into the classroom and now it’s pretty much, it’s close to being integrated completely here this fall.”

“Last year [early design experiences were] done just in 8 of the 40 EF1015 sections. And this year it will be done in all 40 ... I am sure if SUCCEED disappeared tomorrow or if I disappear tomorrow, that this would continue....”

As might be expected, breaking from the standard teaching model was met with skepticism by some faculty. Across each of the four focus areas, ten separate project directors mentioned the reluctance of colleagues to modify existing teaching practices or to participate in innovative teaching programs. Reasons cited for this reluctance varied from tradition and comfort with existing teaching practices, to fear that one’s courses would no longer be needed in a revised curricular set, to lack of importance placed on teaching excellence by the college.

“let’s say we are fairly conservative as a group... intuitively we model ourselves by using previous teachers who appeal to our sense of learning and our format and learning styles.”

“...it’s also closed minds too ... it’s something soft, it’s not real, it’s not real engineering, it’s not numbers and so we shouldn’t be teaching it.”

“Some of them resisted it, I won't name names, but I had a couple of professors... say no, no way I am going to do that in my course.”

“...faculty not being supportive of the project, I think that is going to be our biggest barrier, the biggest blockade....”

“...across the college, [teaching is] not what is rewarded... people don’t give you any ‘atta boys’ or anything for helping the students get through something... there are people who seriously look at teaching, but that is not where the big rewards are in the college.”

Lessons Learned, Project Strategies

Not only did faculty acquire greater facility with new teaching practices, but they also described lessons learned from their experiences to improve future teaching situations. For example, one project leader learned that students should not self-select into their own teams for cooperative type activities. Rather, it is important to take their majors and prerequisite skills into account, and assign teams based upon a diversity of skill. Another project leader found that informal progress reports from students working in the field on real-world projects were insufficient to document students' experiences and learning. More rigorous reporting was recommended to aid summative grading.

SUCCEED projects also helped Virginia Tech faculty better understand the nature of training and support for instructors. Four project leaders described lessons learned from workshops conducted at the university. For example, faculty recommended using trainers who were both engineering researchers as well as excellent teachers, as these individuals are well respected for their ability to meet both demands. A recommendation was also made that the Faculty Development Institute (FDI) or other similar campus group take the lead in "training the trainers" or training faculty leaders in the pedagogy of conducting small group sessions and roundtables. Project leaders also recommended conducting different workshops for faculty with different skill levels, and in small-group formats of 10 to 12 participants so trainers could address individual needs. Cohorts of faculty integrating similar changes into their classes were recommended to work together, test new strategies in their courses, then meet to discuss necessary changes.

"If I were to start again, I would pick several faculty members who share my vision of learning and teaching, you need that ... and then it would have to become a team effort ... one of us could be assigned some learning unit, one of us would test it, review it in a sense, and we would discuss it and improve it...."

Student Outcomes

Anecdotal evidence from faculty suggests SUCCEED projects had some influence on students' learning and motivation. However, to verify evidence of student learning, it will be necessary to track students' grades or review their work samples. Observing students' teamwork and related processes would also help to describe the types of learning taking place. Surveys could be utilized to inform student motivation and to identify SUCCEED-related motivators.

Faculty cited increases in students' writing skills from a writing assessment program, in students' knowledge base from the virtual corporations program, in student ability to undertake team-based, leadership, and professional roles from early design projects, and in students' self-directed learning abilities.

"One of the things I am learning is that students left to themselves are capable of some self learning, which I didn't previously believe, because I used to go to a black board or lecture with transparencies or PowerPoint presentations, and I used to monologue and maybe incite some discussions in the class on a limited scale, but now

given a new set of guidelines, a set of goals and objectives, the faculty consultant, and the time limit of an hour a week or 30 minutes a week, students can self-learn also apart from learning from others, and this is a very important thing.”

The summer bridge program for minorities was cited as improving retention by 20% over minority students who did not participate in the program. Emerging Scholars Program (ESP) sessions, in which students take regular-level courses but receive additional instruction in a small group format, were cited as helping students with poor math readiness scores catch up with students with better math scores in one project, but as having no effect in a project that sought to support students in statics classes. Reasons for this stated discrepancy were that statics students were allowed to self-select into their *optional* ESP session, instead of requiring students with low incoming scores to participate. Finally, in one project that incorporated lab activities into freshmen-level engineering courses, students that took labs were found to perform more poorly than students who did not. Faculty suggested the students with weaker skills tended to take the labs, however, and these individuals could have been expected to perform more poorly than students who did not need extra labs. Further, the “final outcome [of students who took the labs] probably was better than it would have been had they not gone through the lab.”

Several project leaders discussed elements of student motivation. One project leader stated his students were reluctant to sign up for intensive design courses that were simply electives and not part of the curriculum. Despite this perspective, he felt his students “enjoyed” the experience. The motivational aspects of hands-on and real-world projects were similarly noted by four additional project leaders:

“... very good impact ... some of the students send emails saying how much the course was great for them and they enjoyed it.... They had a better understanding of civil engineering because here you had a problem from A-Z. I mean you do not solve let’s say a mathematical problem or build a beam or something, here you are dealing with a ... real life problem....”

“It’s fun to see the students feel good about what they are doing, and some of them just don’t feel that good about only theory, you know they really like working with their hands.”

“...[students] came out with a better sense of how things worked and certainly more interested in engineering than through the standard lecture.... I think after the introduction of the lab, in particular the integration of some of these hands-on early design activities in the class, I think the student perception of the class has changed.”

Other motivational aspects to SUCCEED-sponsored projects included allowing students some responsibility and control over their own learning, in addition to classroom projects where students were tasked with producing educational materials.

“...[students] have to set up a laboratory experiment that is associated with flow ... I review their work and I correct any of the bad mistakes, but I do like to have them try different things, so in running this experiment they can demonstrate why this was a

good technique or why it was not good and they really enjoyed having that freedom to do their own thing.”

“...[students] would go to plants and they would take pictures ... we had ITT locally in town and they were very, very generous and they would let the kids in there, they would gown the kids up in bunny suits and let them go into the clean room with digital cameras and photograph things ... the students liked what we did, it’s effective in the classroom ... grades have gone up, interest has gone up ... my attendance was 100% to the last day of class. The students loved going to see a plant, they said it was far more interesting, they learned more about how a semiconductor manufacturing process worked by going down and seeing the Roanoke facility, writing a segment of it, photographing it, and having to describe in detail what that did.”

Leverage

Project leaders described several instances of SUCCEED projects at Virginia Tech providing leverage to extend and/or grow projects in other settings. For example, SUCCEED project leaders worked with the Center for Excellence in Undergraduate Teaching (CEUT) at Virginia Tech to modify their existing workshops to be more “topic specific and faculty specific,” suggesting this refined engineering focus helped increase attendance in the workshop offerings. Project leaders in the outcomes assessment focus area also directed the development of an instrument and shared this tool with other SUCCEED universities. Within Virginia Tech, two project leaders said the hands-on and design projects developed with SUCCEED funds provided the starting point for the development of additional projects:

“...the SUCCEED money was what made it possible to do some of these things ... develop the supplies to have these small projects develop ... and now the department head has supplied the money for these term projects, the dehydration project and the compost....”

“As a result of the hands-on lab we spun off some other projects, some interdisciplinary projects that I have done with my design graphics class and architects, architecture’s industrial design program. We have done that for several years now too.”

Projects originating at Virginia Tech have also become models by which other schools pattern similar programs. The writing portfolio program, which was provided some funds by SUCCEED, has become a model for “at least four universities,” some of which have visited Tech to gather further information about the program. Project leaders with the Virtual Corporation program indicated “a lot of people are calling us and asking us how the programs are run.... One person came here and interviewed me and wanted to find out about the program....” Project leaders with the Mechatronics curriculum project indicated two other universities were planning to use the electronic boards they developed for hands-on student activity. A few faculty described their plans to market their projects nationally via textbook publishers:

“McGraw-Hill is interested in this textbook ... the way we teach this course with these boards. So we will be putting this ... circuit board in the sleeve of the book and give them the parts list and the vendors and so hobbyists as well as universities around the country can pretty easily get the materials they need to build this kit.”

Changed Industry Impressions

At least three project directors in the student transition area mentioned receiving positive feedback from industry representatives about Virginia Tech graduates.

“I am enthusiastic that Virginia Tech students are already looked upon as very good at hands-on and being good practical engineers.... We have already received some feedback from the automotive industry, a lot of people call and say I want a mechatronic student, do you have anybody who might be interested in this, so I think it’s already having some impact....”

Dissemination Activity

SUCCEED project leaders were involved in a number of dissemination activities to share and publicize their findings with others. At least five project leaders mentioned placing project descriptions, outcomes, or student work samples on the Web for dissemination. Eleven project leaders described delivering posters or presentations about their SUCCEED projects at other universities or conferences. As reported in the processes section under “collaboration,” many faculty also disseminated knowledge or best practices locally to other faculty at Virginia Tech:

“For insiders, at one of our regular faculty meetings, we just brought the stuff into our meeting and we did a mini class with them.”

“each time we generated written reports, ... and the written reports were provided to the faculty and in some cases the faculty I know provided information to students ... this is what General Motors is saying about you and this is what Intel is saying....”

Limitations and Recommendations

This report is based entirely on faculty comments and some project documentation. This data has provided evidence for a need to change teaching practices and to train faculty to do so. The inputs and processes required to accomplish these changes have been outlined, as have specific activities that took place in each project. One limitation, however, is the study reports little more than anecdotal evidence to describe the effects of these innovations on students and faculty. Students were not a part of this evaluation, and their course performance, test scores, work samples, and feedback, could provide a clearer picture of SUCCEED's impact.

Rather than combining any future evaluations into one large study, it is recommended that the college conduct several separate studies. Each focus area is significantly different so as to warrant separate questions to document its impact. Table 3 outlines future study questions for each focus area with suggested instruments to collect relevant data.

Table 3
Future Study Questions and Instruments

impact, outcomes, or effects we would like to document	suggested instruments to obtain this data
<p><i>Faculty Development Focus Area</i> Of the faculty that attended workshops, how many adopted or applied a new practice based on the instruction received? If not, why? What additional supports or changes are needed to existing faculty development structures?</p>	<p>obtain list of workshop leaders and faculty participants in SUCCEED-sponsored workshops and training cohorts (if available), and survey these individuals (projects FD 1-1, 1-2, TC 1-3, 2-1, 2-2)</p>
<p><i>Outcomes Assessment Focus Area</i> To what extent have faculty used the outcomes assessment matrices created to align program objectives with ABET A-K accrediting criteria? Is this tool completely integrated across the college? What is the buy-in?</p> <p>How many faculty are aware of the results of the employer feedback project? Have these comments influenced faculty teaching requirements or strategies?</p>	<p>faculty survey, future ABET accreditation report</p> <p>faculty survey</p>
<p><i>Student Transitions Focus Area</i> What are student reactions to emerging scholars program (ESP) small-group problem-solving and tutoring sessions?</p> <p>What are the effects of ESP sessions on student grades?</p> <p>What are student reactions to hands-on and early design experiences (projects ST 2-1, 2-3, 2-4, 2-6, 3-1, 3-2, 3-4)?</p> <p>What is the nature of student learning through hands-on and early design activities (how has it changed from earlier years, what types of experiences and thinking are students exposed to, and do these experiences have lasting impact)?</p>	<p>student survey</p> <p>grade comparisons against control groups (duplicate of study conducted as part of SUCCEED)</p> <p>student survey</p> <p>faculty interviews regarding changes in student requirements after the integration of hands-on and early design activities; classify a list of student activities from each course into learning taxonomies (e.g., Bloom) and interview student sample to determine the types of thinking students are asked to undertake; assess student knowledge transfer on related problem solving tasks</p>
<p><i>Technology-Based Curriculum Focus Area</i> What are student reactions to technology-based curricular materials (projects ST 2-7, 3-3, TC 1-2, 1-4, 2-4)?</p> <p>What is the nature of student learning through technology-based curricular materials?</p>	<p>student survey</p> <p>faculty interviews regarding methods for teaching content prior to technology and how/if technology has supported different processes and thinking; classify technology-based activities according to learning taxonomies (e.g., Bloom) and interview student sample to determine the types of thinking students are asked to undertake</p>

References

- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills: Sage Publications.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis*. Thousand Oaks, CA: Sage Publications.
- Stufflebeam, D. L., Foley, W. J., Gephart, W. J., Guba, E. G., Hammond, R. L., Merriman, H. O., & Provus, M. (1971). *Educational evaluation and decision making*. Itasca, IL: Peacock.
- Stufflebeam, D. L., & Shinkfield, A. J. (1985). *Systematic evaluation*. Boston: Kluwer-Nijhoff.

Appendices

Appendix A: Semi-Structured Interview Protocol

Name: _____ Interviewer: _____ Date: _____

Context questions (to define institutional context, identify needs of target population and opportunities to address those needs, determine how well project goals address stated needs)

1. What were the stated goals for your SUCCEED project?
2. What were your project outcomes (e.g., Web sites, documents, materials, learning)?
3. What needs, issues, or problems did these outcomes address?
4. Where can we find examples of your outcomes (e.g., the Web site address, the CD-Rom that was developed, documentation that a workshop took place, attendance records, etc.)?

Input questions (to define institutional capabilities, project strategies and designs)

5. What was required to achieve the goals (e.g., equipment, facilities, staff)?
6. What alternative strategies for project implementation might have helped achieve the goals?
7. How did your colleagues gain awareness about your project?
8. Please describe the type of support (from your department, the college, or SUCCEED) that was most useful for you in completing your project

Process questions (to define deficiencies in the process or implementation)

9. How well have the goals been met?
10. How were SUCCEED funds allocated or spent (e.g., equipment, personnel, supplies, programming, etc.)?
11. What barriers threaten the project's success?

Product questions (to define outcomes, judge their worth)

12. Please describe the lessons learned (positive or negative) from your project.
13. Do you believe this project should continue? If yes, what are your suggestions or recommendations for sustaining this project?
14. How did the outcomes of this project impact engineering education at VT?
15. As a result of your participating with this project and SUCCEED, what impact has working on this project had on your views of teaching and learning?
16. Should we leverage the project with another program at VT or with other universities?

Appendix B, Summary of Projects Across Four Focus Areas

Faculty Development Projects (FD)

Objective 1: Prepare faculty members to implement effective instructional methods and provide continuing support for their implementation.

Project Label	Project Description	Funds Awarded				
		Yr.6	Yr.7	Yr.8	Yr.9	Yr.10
Objective 1, Task 1, Project 1-1	Promote and support attendance of faculty development and other coalition focus workshops.			4000	4000	
Objective 1, Task 2, Project 1-2	Present faculty development workshops and engineering community meetings at Virginia Tech. Invite outside experts.			5000	5000	

Outcomes Assessment Projects (OA)

Objective 1: Identify, develop, and test outcomes assessment measures, tools, and methods for critical success factors of engineering graduates.

Project Label	Project Description	Funds Awarded				
		Yr.6	Yr.7	Yr.8	Yr.9	Yr.10
Objective 1, Task 1, Project 1-1	Work with outcomes assessment coalition focus team to develop an outcomes assessment instrument for the design and continuous improvement of the engineering curriculum to produce successful graduates.		3000			
Objective 1, Task 2, Project 1-2	Implement and pilot test the outcomes assessment instrument. Train faculty to develop and use outcomes assessment measures, methods, and processes to improve degree programs.		2000			
Objective 1, Task 3, Project 1-3	Participate in outcomes assessment (OA) and faculty development (FD) shared workshop by sending up to 5 people to CIR workshop or OA conferences.			4000	4000	
Objective 1, Task 4, Project 1-4	Participate in employer feedback project: .5 GA to assist in process of conducting project.			9000	2000	
Objective 1, Task 5, Project 1-5	Participate in portfolio project: .5 GA to assist in process of conducting project.			9000		

Student Transitions Projects (ST)

Objective 1: Establish an early engineering identity and expand the first-year transitioning to include explicit learning skill development and inculcate clear expectations.

Objective 2: Provide students more access to real-world engineering design experience and engineering practice opportunities.

Objective 3: Improve/increase the exposure to engineering design, ethics, and professionalism in introduction to engineering courses.

Project Label	Project Description	Funds Awarded				
		Yr.6	Yr.7	Yr.8	Yr.9	Yr.10
Objective 1, Task 1, Project 1-1	SUCCEED-ESP Calculus. Integrate engineering experiences in some sections of the Emerging Scholars Program (ESP) in Engineering Calculus (Math 1205).	20,000	25,000	9000		
Objective 1, Task 2, Project 1-2	Students at Risk. Implement and expand support for students at risk, college success strategies, and summer bridge program.		5000		15,000	
Objective 2, Task 1, Project 2-1	Virtual Corporations. Form and operate two virtual corporations: (1) the Distributed Information Systems Corporation (DISC) and (2) the Personal Rapid Transit Corporation (PERTS) (institutionalized).	25,000	25,000	9000		
Objective 2, Task 2, Project 2-2	Hands-on Workshop Statics. Develop multidisciplinary (engineering and building construction) hands-on Workshop Statics and integrate it in engineering statics. Use ESP-Calculus as a model for year 8. Four sections of ESP-Statics will be taught and assessed. If successful, the Dean's support will be sought to make ESP-Statics available to all sections of Statics.	25,000	25,000		15,000	
Objective 2, Task 3, Project 2-3	Integrated Building Design. Implement a vertically integrated pilot course in building design, involving students in Civil Engineering and Architecture. Integrate practicing professionals and mechanical and electrical engineering aspects.	20,000				
Objective 2, Task 4, Project 2-4	Infrastructure Project. Integrate multidisciplinary (CE and EE), vertically integrated infrastructure pilot course, involving testing and rehabilitation design (institutionalized).	20,000	15,000			
Objective 2, Task 5, Project 2-5	Workplace Transitioning. Provide workshops and activities in the following workplace transition areas: freshmen, transfer students, seniors, women, and faculty. Organize an engineering organizations fair.	4000	4000	3000	3000	

Objective 2, Task 6, Project 2-6	Biological Systems Engineering. Develop and integrate long term, industry derived design projects in Biological Systems Engineering with horizontally and vertically integrated student teams. This new project started in spring semester 99.		17,500	9000		
Objective 2, Task 7, Project 2-7	Mechatronics Education. Vertically integrated student teams, from mechanical and electrical engineering, are engaged in integrated electro-mechanical design and the development of smart products. The project, proposed for year 8, has industrial connections.			18,000	17,000	
Objective 3, Task 1, Project 3-1	Introductory Engineering Lab. Transform the first freshmen engineering course into a problem solving course with hands-on laboratory experiences and connections to engineering practice.	20,000	25,000	9000		
Objective 3, Task 2, Project 3-2	Early Design Lab. Introduce early design experiences to freshmen. Projects will be adapted from SUCCEED pilots (e.g., Marc Hoit's Knowledge Lab) and other NSF coalitions (e.g., Foundation Coalition's early design products)			20,000	15,000	
Objective 3, Task 3, Project 3-3	Engineering Ethics. This pilot course in Engineering Fundamentals will focus on ethics in primarily engineering fields, with emphasis on recent real world case studies. The course will require the students to research ethics topics, critically evaluate all sides of the issues, and present their findings in both written and in oral presentations. Additionally, an online discussion component will allow the students to debate various topics in a multimedia forum.				10,000	
Objective 3, Task 4, Project 3-4	Engineering Fundamentals Curriculum Renewal. Integrate engineering experiences in EF 1015, specifically hands-on lab and early design activities from the EF SUCCEED pilot courses. Overhaul the curriculum to produce and exciting gateway course to engineering.				20,000	

Technology-Based Curriculum Delivery Projects (TC)

Objective 1: Enhance teacher-student and student-student communication using network-based collaborative environments for academic interaction.

Objective 2: Empower faculty to develop electronic media-based instructional content.

Project Label	Project Description	Funds Awarded				
		Yr.6	Yr.7	Yr.8	Yr.9	Yr.10
Objective 1, Task 1, Project 1-1	Web site for engineering advising.	7000				
Objective 1, Task 2, Project 1-2	Multimedia Statics. Create internet course manager for the multimedia learning environment (MLE) in statics and mechanics of materials; test internet-based MLE for distance education. Implement the MLE in one section of Engineering Mechanics (ESM 3704). Evaluate, maintain, and improve the MLE. Continue dissemination of the multimedia program, and assist faculty adopting this learning environment.	7000	8000	8000		
Objective 1, Task 3, Project 1-3	Technology Infusion. Form faculty teams to implement various technology tools and techniques. Teams will consist of faculty teaching different sections of the class along with the graduate students who support them.			18,000		
Objective 1, Task 4, Project 1-4	Multimedia Microelectronics. Team-developed multimedia presentation of microelectronics-oriented processing technologies such as silicon and gallium arsenide manufacturing and fiber-optic cable manufacturing. Teams of students work with industry to develop multimedia learning modules suitable for both industrial training and for student learning at the community college and university level.			9000		
Objective 2, Task 1, Project 2-1	Master Technology Teacher Training. Selected faculty will attend TBCD workshops and become well-versed in the use of technology-based tools for teaching engineering. These faculty will then share their experience and expertise with other VT engineering faculty. The training of MTTs will be closely integrated with the already existing FDI program on the VT campus. Some TBCD sessions will be offered at VT.			8000	8000	

<p>Objective 2, Task 2, Project 2-2</p>	<p>Comparing Internet-based Education Methods. Hold roundtable discussions on best practices in Internet-based instructional methods. Integrate discussions with the University's Faculty Development Institute (FDI) an ongoing departmental activity.</p>	<p>9000</p>	<p>9000</p>	<p>5,100</p>	<p>4000</p>	
<p>Objective 2, Task 3, Project 2-3</p>	<p>Technology Production Assistance. Faculty will be provided with the multimedia production assistance needed to incorporate the use of technology into their teaching. Assistance will consist of basic support for production operations such as digitizing text, images, sound, and movies. Help will also be provided in assembling raw materials into product form.</p> <p>In addition, faculty will be assisted in creating an instructional web presence for sophomore and junior level engineering courses. This web presence will contain a baseline of instructional materials as well as online support materials for instructional units. The development team will use best practices, for creating online learning experiences, identified in prior succeed project and from the report: Quality on the Line: Benchmarks for Success in Internet-based Distance Education prepared by the Institute for Higher Education and Policy.</p>			<p>9900</p>	<p>35,000</p>	
<p>Objective 2, Task 4, Project 2-4</p>	<p>Technology Implementation and Assessment. Specific topics from ECE 3614 Intro to Communications will be modularized and developed into a format for asynchronous Web delivery. Established educational techniques will be used during the development. The project will closely follow the development and use of the modules in order to assess the process as well as assessing the effectiveness of the use of technology.</p>				<p>10,000</p>	

Appendix C: Macro and Micro-Level Codes

<i>Macro Codes</i>	<i>Descriptions</i>	<i>Emergent Micro Codes</i>
Administration	evidence of administrative support for a project, or administrative influence on a project, whether good or bad	<ul style="list-style-type: none"> • Setting an example, participatory • Monetary leverage • Moral praise, encouragement, latitude • Not supporting a project, being a barrier • Marketing, talking-up, promoting a project • Wielding authority to get things done
Assistance	providing faculty with technology production assistance	<ul style="list-style-type: none"> • Re-categorized as a micro code under the “needs” macro code
Attitude	stated student, staff, or faculty perceptions of certain courses, projects, tasks, or people; includes faculty respect for engineers teaching workshops above and beyond a general instructor--an "attitude" that such individuals would know more or would know better	<ul style="list-style-type: none"> • Engineers are conservative as teachers, traditional • Predicted changes in how one views their role as teacher • Uncooperative behavior, unresolved, unchanged • Finger pointing • On the role of an engineering faculty member as “teacher” • Industry attitudes • Attitudes about faculty reward structure and its effect on teaching
Behavior	evidence that a project led to a change in faculty behavior (possibly related to "pedagogy" code where a new teaching/learning strategy was attempted)	<ul style="list-style-type: none"> • Improved teaching practice, changes made • Motivation for lifelong learning, continuing education
Collaboration	situations in which collaboration between colleges, departments, or universities took place or is recommended to sustain a project; when other universities' projects were used to help inform projects at Tech, consulted	<ul style="list-style-type: none"> • Researchers, conducting common studies, sharing results (to develop bigger picture) • Promoters, people to help market/advertise a project to different audiences (Joint Offerings) • Planners, brain trust, colleagues to help plan a project • Worker bees, colleagues to help implement/carry out a project • Evaluators, collaborators who help provide feedback, opinions • Professionals, Industry Collaboration • Technical Support Staff Collaboration
Community	efforts to build community within the college, among students, among faculty and students, etc.	<ul style="list-style-type: none"> • N/A*
Curriculum	issues related to 3-credit "core" offerings versus 1-credit offerings, issues related to electives versus "core" offerings; reluctance on the part of students to take a course because of its "fit" in the curriculum	<ul style="list-style-type: none"> • Curriculum is so full, limits ability to add new programs • Innovative SUCCEED courses aren't in curriculum yet, don't count for certain credit requirements and as such detract from student interest • Accreditation of curriculum slows modifications to curriculum

Dissemination	how a project is described to others, simply telling others about it, presenting at conferences (don't confuse with "promo" code which is actually adopting measures to get others to employ a new practice, and don't confuse presenting at conferences with "trav" code which is simply traveling to or attending a conference)	<ul style="list-style-type: none"> • Reporting on projects (usually to other universities or engineering faculty) • Local dissemination to Tech faculty and students • Employer dissemination, to show employers what students are doing • Project outcomes used to recruit students, promote Tech's College of Engineering
Environment	comments related to an ideal or less than ideal teaching environment, class size, facilities, etc.	<ul style="list-style-type: none"> • Class size makes it difficult to adopt certain classroom strategies/activities; not enough lab or human resources to accommodate • Flexible space issues, facilities
Expenditure	description of what project funds were spent on	<ul style="list-style-type: none"> • N/A*
Graduate assistants	includes undergraduate assistants as well, situations in which GAs are used to support a project	<ul style="list-style-type: none"> • Training student assistants • Helped with data analysis • Helped with technology production • Monitored students in dorms • GTA's present in a project, supporting teaching/classroom/lab prep activities
Horizontal integration	getting same-year students across the multiple engineering disciplines to take a similar course, apply their various strengths to a new course	<ul style="list-style-type: none"> • Re-categorized as a micro code under "pedagogy" macro code
Institutionalization	evidence that a project has been widely accepted and merged with the norms of the college culture	<ul style="list-style-type: none"> • N/A*
Iterative	a development process of action, reflection, and revision, or of rapid prototyping with beta testing and revision, "just do it" and revise what doesn't work	<ul style="list-style-type: none"> • Making regular updates to online information that changes • Iterative interface testing • Modifying curriculum, or what is taught • Modifying teaching practices
Leadership	the need for leaders, someone who takes the lead and pushes through a number of initiatives	<ul style="list-style-type: none"> • N/A*
Learning	evidence of student learning or lack thereof, changes in understanding (see "pedagogy" code for techniques to accomplish or improve learning)	<ul style="list-style-type: none"> • Changes in skill, knowledge • Comparison of students in remedial, scaffolded treatment groups with those in regular classes • Appreciation for other disciplines
Leverage	how a project is or could be further supported with the aid of additional funds, other personnel, technology, corporation donations, etc.; evidence that a SUCCEED project provided leverage to grow another project (two sides of leveraging--to be leveraged, to leverage)	<ul style="list-style-type: none"> • N/A*
Money	faculty talking about the need for money, as in an input to sustain or continue a project, not to be confused with "expenditure" which is how the funds were actually spent	<ul style="list-style-type: none"> • N/A*

Motivation	evidence that something is a motivator for a certain audience (students, faculty, staff), or that students have a lack of interest	<ul style="list-style-type: none"> • Motivators to change teaching practice • Evidence of faculty motivation (see also “attitude” or changes in behavior) • Evidence of student motivation or unmotivation
Multidisciplinary	a project involving multiple departments; not just engineering, but architecture, business, etc. not to be confused with "horizontal integration" code which is different engineering departments participating in a course or project	<ul style="list-style-type: none"> • Re-categorized as a micro code under “pedagogy” macro code
Need	a gap or problem that has been identified and served as the impetus for change or for some project	<ul style="list-style-type: none"> • Greater student exposure to diversity of skills • Changing nature of disciplines, new requirements • Retention of non-traditional engineering students, at-risk students • Higher passing rates in difficult classes, helping students acquire needed skills • More technology production assistance for faculty, workshop follow-up support
Novel	evidence that something being attempted is new, novel, or of interest to others	<ul style="list-style-type: none"> • N/A*
Pedagogy	evidence of a specific teaching/learning strategy being adopted or incorporated into a course	<ul style="list-style-type: none"> • Hands-on experiences, labs, experiments • Real-world problems, design projects • Teams, cooperative groups, peer scaffolds • Self-learning, self-regulated learning • Drill and practice, simulations • Communication, presentation skills • Constructionism--student research and production of content • Integration, horizontal • Integration, vertical • Integration, multidisciplinary
Professionals	the interaction of outside experts and in-field professionals with students in a course or program	<ul style="list-style-type: none"> • N/A*
Promotion	how a project is sold or promoted to others in an attempt to get people to actually adopt the practice, marketing--selling; evidence that a product or practice has been adopted by others	<ul style="list-style-type: none"> • Giving workshops, presentations, training sessions, training other faculty • Advertising events, workshops, courses (e-mail, word of mouth, flyers) • Promoting widespread use via collaboration with textbook publishers
Scaffolding	support structures in courses, an effort to provide students with "just-in-time" help or assistance with difficult courses, topics, etc.	<ul style="list-style-type: none"> • Scaffolding via classroom strategies, peer support, cooperative learning • Programs for at-risk students
Standards	mention of standards or an accrediting agency as motivators or drivers for a project or task	<ul style="list-style-type: none"> • Projects specifically designed to align VT COE with national standards • Faculty awareness of ABET standards and their relation to their courses • Projects hindered by ABET accreditation

Strategy	a recommended process or strategy for carrying out a project--here's what I would do differently..., here's what we learned about teaching..., here's the best way to conduct workshops...	<ul style="list-style-type: none"> • Prerequisites must be accounted for when assigning teams, courses • Workshop design, speaker selection, small class size, production support, similar prerequisite levels, topic specific • Promoting change in teaching practice, small changes, cohorts • Separating departmental outcomes to pinpoint specific changes needed in programs • Further training for faculty • Using technology as a solution to large class size and inactivity • Pedagogy, multidisciplinary • Scaffolding student team work, assessing interim progress • Involve more evaluation • Monitoring or mentoring TA's
Student skills and styles	descriptions of student skills and/or learning styles that effect the success of a course... lack of team skills, lack of prerequisite knowledge, etc.	<ul style="list-style-type: none"> • Lack of teamwork skills • Lack of communication skills • Lack of study skills • Lack of mechanical skills • Lack of prerequisite skill • Improved writing skills • Improved math readiness skills • Improved self-directed learning skills
Supplies	descriptions of the materials and technologies needed as inputs for a given project, to carry out a project	<ul style="list-style-type: none"> • Web communications • Supplies and equipment for experiments and labs • Hardware and software for developing teaching materials • Food, meals
Tasks	student and faculty tasks and activities associated with a specific project--what they did or what they do	<ul style="list-style-type: none"> • N/A*
Time	mention of the need for time, the lack of time, to develop a project; the comp time awarded to a faculty member to complete a project	<ul style="list-style-type: none"> • Time as a barrier to implementing workshop techniques • Time as a barrier to managing projects, with research and other teaching obligations looming and with tenure track pressure; the need for a proactive person who is motivated as a teacher • Takes time to produce project materials, technologies; although new changes in technology make production faster • Time as a barrier to writing up or reporting project results • Flip side to time as a barrier--Projects provide faculty with needed time to accomplish a task, impetus, motivation
Tradition	evidence that someone is doing something based on tradition or is reluctant to change a practice based on tradition	<ul style="list-style-type: none"> • N/A*

Training	situations when faculty/students were formally trained to do something; targeted for training on some task or procedure or software	<ul style="list-style-type: none"> • Training opportunities for student groups • Training opportunities for faculty
Travel	faculty, student, or GA travel to conferences (use the "dissemination" code if faculty were presenting, and use this code if they simply attended the conference without presenting their SUCCEED project)	<ul style="list-style-type: none"> • N/A*
Vertical integration	situations when students from freshmen to seniors are enrolled in the same class to learn from one another and take advantage of "big-brother" aspects	<ul style="list-style-type: none"> • Re-categorized as a micro code under "pedagogy" macro code
Vision	comments related to lessons learned or best practices, how faculty envision their project effecting the larger engineering education practice	<ul style="list-style-type: none"> • N/A*

* N/A—not applicable, instances when macro code could not be split into sub-levels or when each instance of a macro code generated a different sub-level so as to render their differences unimportant.

Appendix D: Individual Project Summaries

Project Label and Title	FD1-1 and 1-2, Promote attendance and present faculty development workshops.
Personnel	Siegfried Holzer
Stated Goals or Needs Addressed	"...our main goal really was to create a community of learners who care about and study about learning strategies, teaching strategies, implement those, share experiences and problems ... one on one or in groups or even e-mail, and as a consequence, continue small incremental improvements...." "I felt that a learning community was essential because if you give a workshop and you don't follow it up, we are all so busy that we don't have the time. ... it was a support group... we tried to bond faculty, we wanted to get, ideally create a critical mass of faculty members. That was the long-term goal that once you have a critical mass it propagates itself...."

Funds Awarded	Stated Expenditures
\$9,000, year 8 \$8,000, year 9	speaker travel, honorariums, faculty travel to teaching and learning conferences, refreshments at campus workshops

Project Activities
<p>Invited speakers would give presentations at Virginia Tech on topics such as problem-based and cooperative learning, then the attendees would have an informal discussion with the presenters and each other. A few faculty were sent off campus to attend workshops at other institutions.</p> <p>"...we have these learning community meetings or (socials) as I called them and they were very friendly, we would have, for example, specialty coffee at lunch or have wine and cheese in the afternoon meetings, and what we do is we would ask, frequently I would ask someone, again who impressed me, who implemented some of these learning strategies in a classroom to become the discussion leader."</p> <p>A sampling of faculty development workshops presented as part of this project (and attendance data when available):</p> <ul style="list-style-type: none"> • case study methods, co-sponsored by Center for Excellence in Undergraduate Teaching (36) • cooperative learning in Engineering, speaker Smith (46) • creativity and problem solving, speaker Kander (25) • designing a course for online delivery (20) • Engineering distance education, speaker Miller (28) • learning community meetings on effective teaching (32, 22) • mentoring new faculty, Felder/Brent speakers (42) • new engineering faculty seminar, speaker Vorster • principles of good practice in Engineering, co-sponsored by CEUT (62) • seven graduate teaching assistant (GTA) seminars

Project Label and Title	OU1-1 and 1-2, Develop outcomes assessment instrument and train faculty to use instrument.
Personnel	Pamela Kurstedt, Bev Watford
Stated Goals or Needs Addressed	“The stated goal was to identify and refine instruments ...to collect data on where we were in the curriculum planning process in terms of identifying and measuring outcomes [required by the ABET accreditation standards].”

Funds Awarded	Stated Expenditures
\$5,000, year 7	faculty travel to workshops, cost-shared graduate assistants

Project Activities	
<p>As a result of this project, the College of Engineering established a “series of matrices” that matched program objectives with the “A-K outcomes” required by the engineering accrediting agency ABET. This task ensured the College had covered each required outcome and illustrated which courses provided this coverage.</p> <p>“And in most departments every faculty member going through this process has had to take their courses, say my course meets these A-K criteria from ABET, and they have to put that down in writing and then the curriculum committee reviews it... every faculty member has to look at their course in light of the A-K criteria.”</p>	

Project Label and Title	OU 1-3, Participation in CIR/OA outcomes assessment workshops and conferences.
Personnel	Bev Watford
Stated Goals or Needs Addressed	The goals for the project, “were to educate faculty on outcomes assessment, bottom line.”

Funds Awarded	Stated Expenditures
\$4,000, year 8 \$4,000, year 9	faculty travel to attend workshops, “I probably sent... 9 or 10 a year... sometimes what the departments would do is they would pay for one person and I would pay for one person from their department so they would get two that could go....”

Project Activities
Selected faculty were trained in “how to evaluate outcomes assessment.” Faculty were sent to: Rose-Hulman University “who runs an outcomes assessment institute like every summer or spring,” outcomes assessment workshops sponsored by the accrediting agency ABET, and related sessions held at professional meetings of groups such as the American Society of Civil Engineers and the IEEE. After training, "...what [faculty] were to do was to come back and educate their faculty about what they learned so they disseminated the information around their faculty."

Project Label and Title	OU1-4, Employer Feedback Project.
Personnel	Bev Watford
Stated Goals or Needs Addressed	“... [industry] in some cases really dinged our students for their lack of ability to communicate and I think that ...caused some faculty and some departments to try and increase the level of communication skills required in different classes.”

Funds Awarded	Stated Expenditures
\$9,000, year 8 \$2,000, year 9	staff wages to conduct/analyze focus groups, “...it was literally 8 hours a day for two days to do one set of focus groups, and then the transcribing and analysis of the qualitative data...”; food was provided for focus group participants

Project Activities
<p>Project staff conducted focus groups with industry representatives (e.g., General Motors, Intel) who were on campus interviewing students to determine the type of students they wanted to hire and the qualities they were seeking. Written reports were developed and provided to faculty. In some cases, faculty shared report comments with students to communicate industry expectations.</p> <p>The project team initially conducted focus groups with various industry representatives, but then changed their strategy to conduct focus groups with representatives in specific curricular areas (e.g., electrical, mechanical). “I want to say there were two focus groups on electrical engineers, I think there was one on civil engineers, I think there was one on mechanical, I think there were two or three on computer engineering...”</p>

Project Label and Title	OU1-5, Writing Portfolio Project.
Personnel	Eric Pappas
Stated Goals or Needs Addressed	The program is designed to teach writing and communications to engineering students, not only to improve their skills, but also their personal development on issues such as ethics and values in their profession. The project leads to two outcomes: tracking student progress over time and providing students with a tool to use when entering the workplace. Approximately 25% of students involved in the program use their portfolios formally as part of the interview process, and a majority of students list their portfolio experience on their resumes.

Funds Awarded	Stated Expenditures
\$9,000, year 8	faculty wages, faculty travel

Project Activities
<p>The writing and communications program is experienced by all students in the Materials Science and Engineering department (MSE) and components of the program extend to other departments as well. A one-credit course is taken by MSE students to develop a portfolio of work, drawing from seven specific courses taken over three to four years. Eric Pappas teaches or team-teaches four of these courses, and he is a guest speaker in each course. Eric discusses such topics as writing proper workplace lab reports.</p> <p>SUCCEED funds provided Eric and his staff with time to conduct research on improving a pre-existing portfolio program. The writing portfolio program was upgraded to address new ABET standards and to include general communications components. The old program focused solely on writing and public speaking, while the new program includes student work on ethics, service, and environmental projects. The new program is both longer and more extensive in scope.</p> <p>A 1996 article by Eric Pappas in the Journal of Engineering Education highlights the success of portfolios in documenting significant increases in student writing skills. Eric was contacted by and worked with Sue Legg at the University of Florida to document the process of creating writing portfolios in engineering writing communications programs. The project staff hoped to train others to create similar writing programs by describing "exactly what we do, how we do it, how we graded it..."</p> <p>Eric provided Sue with sample writing documents in helping to create a Web site with streamed video documenting the process. As Eric described, writing portfolios may include a number of items: "...students have to turn in somewhere in the vicinity of between 80-90 pages of work... 3 or 4 lab reports and progress reports, a senior design project, another 10 page project, a number of those things that were written, evaluated by me or one of my staff members, given back, revised and resubmitted...."</p>

Project Label and Title	ST1-1, SUCCEED ESP Calculus.
Personnel	G.V. Loganathan
Stated Goals or Needs Addressed	“What data...the math department had, the so called math readiness core for students to get into the regular engineering calculus sequence, and it was unfortunate almost 50% of the students couldn’t make it by that threshold so they were exploring ways to teach particularly the freshman calculus for engineering students in a better way and that is where they instituted this program called the ESP, the Emerging Scholars Program...”

Funds Awarded	Stated Expenditures
\$20,000, year 6 \$25,000, year 7 \$9,000, year 8	GA’s, equipment

Project Activities
<p>Instead of teaching a pre-calculus course which students were "unhappy" with since it repeated high school work, this project instituted an ESP program which supplemented the existing calculus course. The ESP-calculus course presented the same content as non-ESP calculus courses, but added a one extra credit hour class in which students worked "a lot of group problems to reinforce what they had learned in the regular lecture."</p> <p>Further, the project staff "built [their] own equipment" and instrumentation that would allow students to conduct hands-on lab experiments, and created a CD-Rom that would simulate the experiments for students who could not make it to the lab. Calculus material was introduced via lecture, then students could experience lab-based and/or CD-Rom experiments to help understand the presented concepts. "...the students if they have the opportunity they will come to the engineering labs, do the experiments, whether they have that opportunity or not they can obviously use the CD-Rom to see how the experiment would work."</p>

Project Label and Title	ST1-2, Students at Risk, Bridge.
Personnel	Bev Watford
Stated Goals or Needs Addressed	“The retention of African American students...in engineering, is about...half that of majority students. Studies have shown that the first semester performance of a first year student basically... predicts the probability that they will remain... if you are over 3.5 it’s like 95%; if you are between 2.5 and 3.0 it drops down to 50%; and if you are below a 2.5 or 2.0 it drops down to nothing.”

Funds Awarded	Stated Expenditures
\$5,000, year 7 \$15,000, year 9	faculty wages, GA’s, textbooks, and room and board for participants

Project Activities
At-risk students are housed on campus for five weeks and attend pre-college classes in “chemistry, chemistry lab, calculus, and ... engineering problem solving.” Project staff obtain and track grade and retention data to compare at-risk students who attend Bridge classes against at-risk students who do not. Project staff also maintain a Web site describing the program with downloadable application forms.

Project Label and Title	ST2-1, Virtual Corporations.
Personnel	Krishman Ramu
Stated Goals or Needs Addressed	“...we wanted to create a multidisciplinary (engineering team) that can work with business teams and with all students from different disciplines across the university ...so that they can reflect the social economic and the business context of the society itself... address problems of infrastructure that are facing the nation.”

Funds Awarded	Stated Expenditures
\$25,000, year 6 \$25,000, year 7 \$9,000, year 8	GA’s, “SUCCEED provided one GA approximately for the past two years”

Project Activities
<p>Two virtual corporations were created: the Personal Electric Rapid Transit System, and the Distributed Information Systems Corporation. Students are tasked with solving realistic problems and gain real-world product development experience while in school. They work in laboratories to develop mock solutions.</p> <p>The project is vertically integrated: undergraduate students communicated their processes with graduate students using Web tools. Project staff documented design approaches, business approaches, and research approaches.</p>

Project Label and Title	ST2-2, Hands-on Workshop Statics.
Personnel	Hugh Munson
Stated Goals or Needs Addressed	“To try to help the kids pass statics, that’s very pure and simple....”

Funds Awarded	Stated Expenditures
\$25,000, year 6 \$25,000, year 7 \$15,000, year 9	faculty wages, GA’s

Project Activities
<p>55 students in a treatment group received extra instruction in an Emerging Scholars Program (ESP), small group format. The instructor selected problems from a statics textbook for the students to work and discuss in bi-weekly group "workshop" sessions. Hands-on exercises were not developed as planned. The ESP treatment group was compared against a control group. Each group had the same statics teacher and the same GPA at the start of the semester. The assessment scores obtained were similar for each group, thus the ESP approach was determined to be ineffective.</p> <p>One reason given for the equivalent performance of the two groups was that ESP students possibly substituted their extra help for another source of help (a peer, personal contact with the instructor, personal study time), instead of adding the extra help onto these other sources of help. Further, students self-selected into ESP-Statics on a voluntary basis. It was recommended that if Engineering "identified the kids as likely to fail... [then required these students] to take ESP statics, that would be a good thing." This required approach was successfully adopted on campus in the Mathematics department.</p>

Project Label and Title	ST2-3, Integrated Building Design.
Personnel	Sam Easterling
Stated Goals or Needs Addressed	"We were trying to do two things, integrate a design experience across grades levels...vertical integration...providing an opportunity for sophomores and juniors to participate with the...majority of the work being seniors.... And then horizontal [integration]... I suppose the principle objective was to get the architects and the structural engineers together and then deal as we could with the vertical integration."

Funds Awarded	Stated Expenditures
\$20,000, year 6	faculty wages, GA's

Project Activities
<p>Faculty met with the 25 students taking the course approximately once every three weeks in a large group. Faculty also met with student teams weekly while they worked on their projects. Informal written and oral progress reports were taken as students worked on projects. Sophomore and junior-level students participated in the design process less than the seniors, but conducted some tasks such as drawing designs.</p> <p>This course was held once, but had minimal enrollments at other times and was canceled. It was suggested that engineering students may have been reluctant to take this elective design course on top of their other required design courses.</p>

Project Label and Title	ST2-4, Infrastructure Project.
Personnel	Imad Al-qadi
Stated Goals or Needs Addressed	"The course supports the vertical integrated approach... the first time it is applied at Virginia Tech. ...the course also covers interdisciplinary materials between the departments."
Funds Awarded	Stated Expenditures
\$20,000, year 6 \$15,000, year 7	GA's, equipment, speaker travel to Tech

Project Activities	
<p>Students were assigned real-world, infrastructure problems to solve in teams of four to five. Each team contained, sophomores, juniors, seniors, and graduate students. Students were assigned specific tasks to complete where they inspected infrastructures. Sophomores and juniors attended a one-credit class to pick up necessary background information about infrastructures and materials the first eight weeks. After that, they were not required to be in the course with the seniors who learned about advanced technologies, but they were required to work on the final project presented at the end of the class.</p> <p>Student tasks included such processes as: "proposing different solutions for how to fix this problem and then after that ... evaluating the different alternative solutions economically based on life-cycle cost analysis and recommending the alternative that has the greatest benefit to cost ratio. The whole process is documented in a professional report and presented by the students' group. The process is from A to Z what a competent forensic engineer would do."</p> <p>Students completed fieldwork and ran experiments such as non-disruptive testing to assist groups such as the Virginia Department of Transportation studying bridges and underground culverts and the Town of Blacksburg studying water tank problems. Faculty arranged projects for students, facilitated contacts, and oversaw necessary permissions to work off campus.</p>	

Project Label and Title	ST2-5, Workplace Transitioning.
Personnel	Bev Watford
Stated Goals or Needs Addressed	“Students who are looking for jobs basically and trying to help them develop the skills necessary to be a successful job applicant.”

Funds Awarded	Stated Expenditures
\$4,000, year 6	speaker honorariums, refreshments
\$4,000, year 7	
\$3,000, year 8	
\$3,000, year 9	

Project Activities
Project staff coordinated a series of seminars with Business and Career Services and advertised these to engineering students. “...we will get industry people to come in and do mock interviews and let the students see how people interact and what they are supposed to be doing.” “...there might be some people from Career Services talking about your resume, because they have skills in that, but a lot of times it's using industry people, new graduates, you know what I learned my first day on the job or what I needed to know my first day on the job.” “One thing that we had was an etiquette dinner where the students [learned] how to interview over a meal.”

Project Label and Title	ST2-6, Biological Systems Engineering Design Project.
Personnel	Gene Haugh
Stated Goals or Needs Addressed	horizontal and vertical integration; “the other [goal] was to get international design projects and make this a little more global type design experience.... experimental learning was another goal... hands-on laboratory projects”

Funds Awarded	Stated Expenditures
\$17,500, year 7 \$9,000, year 8	GA’s, equipment

Project Activities
<p>“...what resulted from this though is a list of research design projects that the students have done at the senior level and at the sophomore level....” Engineering students were given design tasks for such items as dog kennels, cleanup sites for underground water that had become contaminated, vineyard compost facilities, and elephant garlic. Engineers worked with students in other fields: “...they didn’t know anything about the cultural practices so working with an agronomy student would help, and then also economics plays such a big part, and so I was wanted to get an Agricultural Economics student involved with our team.” Seniors received supervisory experience over the sophomores. Sophomores were encouraged to use AutoCAD; a skill taught the freshman year but often not applied until the senior year. Students worked in hands-on laboratories, where “...they actually design, build, test, and retest, even at the sophomore level....” Students submitted regular memos and progress reports to the instructor.</p>

Project Label and Title	ST2-7, Mechatronics Education.
Personnel	Will Saunders
Stated Goals or Needs Addressed	“A lot of the old functions of electrical engineers really are being taken over by mechanical engineers, motors and analogue design, but it’s not just analog design, its this idea that with the advent of digital processing chips and micro controllers and things like that, every product and every process has become somewhat digital. It really addressed the need to get mechanical engineers more diverse in their design, more comfortable with hands-on work especially related to electronics right because a lot of mechanical engineers will stay away from the electrical side.”

Funds Awarded	Stated Expenditures
\$18,000, year 8 \$17,000, year 9	equipment, programmer wages, faculty wages

Project Activities
A mechatronics curriculum was created for seniors as a technical elective. To facilitate vertical integration, some of the course principles were integrated into a new, sophomore-level design course, ME 2024. A Web site was generated discussing mechatronics design principles for these students. Equipment called the “VT Project Box” with a mounted “VT 84 board” was created along with software called the pic-visual developer. Sophomore-level students use the “drag and drop” software “...to use block names like add, divide, multiply, analogue to digital conversion to create software that runs on this board.” Students did not assemble the five boxes, but rather, used the software to manipulate the “VT 84 Board.”

Project Label and Title	ST3-1, Introductory Engineering Lab.
Personnel	Richard Goff
Stated Goals or Needs Addressed	“...we felt that the students were coming into school these days with very poor mechanical skills, but they had very good virtual skills, they were excellent with computers... but they have lost that skill that we developed when we were kids when we were working on our bikes and our cars... they weren’t doing so much of that anymore. So we were finding they were lacking in those areas, that was one of the goals: to increase their mechanical skill level. And the awareness of how things worked, with how various small devices worked such as drills or cameras, how did they actually work.”

Funds Awarded	Stated Expenditures
\$20,000, year 6 \$25,000, year 7 \$9,000, year 8	faculty wages

Project Activities
<p>This project instituted various hands-on laboratory activities for Freshmen taking the Engineering Fundamentals 1015 course. Since over 1200 Freshmen take this course, students could opt to self-select into the lab as part of their course. They were not required to do so. Project staff would like to give all 1200 Freshmen a hands-on laboratory experience, possibly by integrating such activities beyond EF 1015 into other classes such as the design graphics class.</p> <p>Although this project is related to Succeed project ST 3-2 in terms of goals, it involves actual laboratory experiences, whereas project ST 3-2 involves students in hands-on manipulations during their actual class sessions. Every team of four freshmen were given a "McGuyver box... to build devices [as homework] and little gadgets to solve certain engineering problems." Students also undertake such activities as working with Lego kits and disassembling and reassembling Briggs and Stratton engines in the lab.</p>

Project Label and Title	ST3-2, Early Design Lab.
Personnel	Jeff Connor, Richard Goff
Stated Goals or Needs Addressed	“The stated goals were to introduce engineering through a more hands-on, self-learning type environment. Traditionally, its been a lecture course where they read the material and they are lectured, helped them along with their own self discovery.”

Funds Awarded	Stated Expenditures
\$20,000, year 8 \$15,000, year 9	faculty wages, GA’s

Project Activities
<p>This project was a pilot in eight of the 36 Engineering Fundamentals 1015 sections (32 students per section). Starting in Fall 2001, the hands-on activities will be integrated into all sections of EF 1015. The hands-on activities take place in the actual classroom, not a laboratory facility, which is what distinguishes this project from project ST 3-1.</p> <p>Eight hands-on projects were created for students. “We try to ... develop activities that can be accomplished in 20 minutes time... rather than... teach precision and units to new engineers [by] lecture from the book. So what we do now is we now give them a somewhat geometrically complex block of wood, and then we say in class... measure this, ...weigh it, ... sketch it, and then your homework assignment is to go back and from this data ... talk about the precision, ... to what degree ... to what precision was the object manufactured ... to what precision were you able to measure the object ... do things like find the density, find the specific weight and manipulate all these units.” “...a typical class would be homework review for 10 minutes, quiz for ten minutes, hands-on for 20 minutes, what am I up to, and then 10 minutes of lecture....” “...one goal was to keep everything as simple as possible so the equipment we use is standard tape measure, postal scale, yard stick.”</p>

Project Label and Title	ST3-3, Engineering Ethics Online Course.
Personnel	Mary Cummings
Stated Goals or Needs Addressed	"With the ever-increasing complexity of technical and global issues in the engineering profession, engineering ethics has become a central issue in both the academic and professional environments. In fact, the Accreditation Board for Engineering and Technology (ABET) now requires that all engineering students have 'an understanding of professional and ethical responsibility' (ABET Engineering Criteria 2000.) Because of the extensive social impact of engineering and the applications of technology, ethics and the role of the engineer can no longer be considered of only slight importance. Virginia Tech seeks to prepare its graduates for the future through instruction in both the importance of ethics in the engineering profession and the global impact of central ethical issues."

Funds Awarded	Stated Expenditures
\$20,000, year 9	course currently under development

Project Activities
A Web site has been completed with the following course components: "...quizzes, surveys, assignments, lectures, all the Power Point presentations ...narrated presentations of [the lecturer]." In Summer 2002, two faculty workshops will be held "...on how to integrate engineering ethics into the classroom."

Project Label and Title	ST3-4, Engineering Fundamentals Curriculum Renewal.
Personnel	Richard Goff, Jean Kampe, Tamara Knott
Stated Goals or Needs Addressed	“The curriculum renewal project was generated out of the notion that the first two freshmen engineering courses, introduction engineering one and two, were very heavy on content that didn’t go into any real depth in any particular subject and were somewhat abstract. ... So what we wanted to do with the curriculum renewal was to introduce more hands-on, early design activities....”

Funds Awarded	Stated Expenditures
\$20,000, year 9	faculty wages

Project Activities
<p>Early design experiences from Succeed project ST 3-2 were modified for integration into the first two engineering courses for Freshmen: an engineering problem solving course, and a design and graphics course. Project ST 3-2 represented a pilot test of design experiences in selected sections of Engineering Fundamentals, while this project represents an effort to integrate such activities into the two courses taken by all 1200 freshmen. While most design activities described for project ST 3-2 were adopted or modified for this project, some were removed and some new activities were created.</p> <p>Project staff met to work on the following activities: seek better ways to deliver course material, reorganize course material, revise course syllabi to include more hands-on activities, and plan for the consistent integration of hands-on activities by the 12 to 13 faculty teaching courses to the 1200 Freshmen.</p>

Project Label and Title	TC1-1, Web Site for Engineering Advising.
Personnel	Pam Kurstedt
Stated Goals or Needs Addressed	“We were to develop a multimedia tool to enhance the advising for perspective freshmen and for enrolled freshmen in the COE at Virginia Tech. ... We thought giving them a CD with this information about each and every faculty member in each and every degree program would be more convenient for them and more interesting for them than just giving them a catalog.”

Funds Awarded	Stated Expenditures
\$7,000, year 6	faculty wages, cost-shared equipment

Project Activities
A CD was produced and distributed to incoming freshmen and prospective visiting students at the end of year 6. The CD listed: “all of the degree programs..., required courses, ...the flow diagram of how students would proceed through the curricula, and ... a page on each faculty member, and a picture of them, what they taught, where they got their degrees, where their office was, what their telephone number was, how to get in contact with them, what their areas of interest were, and then we had video clips from every department head on that CD.” The CD was scrapped and all information was moved to the emerging Web after two years of usage.

Project Label and Title	TC1-2, Multimedia Statics.
Personnel	Siegfried Holzer
Stated Goals or Needs Addressed	"it is fairly well known anyhow, in fact statics is a killer course to this day." "...if you take a look at strategies that have proven themselves for effective teaching and learning, well statics violates almost all of them."

Funds Awarded	Stated Expenditures
\$7,000, year 6 \$8,000, year 7 \$8,000, year 8	GA's

Project Activities
<p>A multimedia program was pilot tested on junior-level architecture students taking a statics course based on experiential learning theory. The program is utilized as part of a course structure that includes workshop-style cooperative learning activities. Students work on a computer as a pair, and are asked to engage in reflective discussions as a team. A typical course session might include these instructional activities: a warm-up problem, 10-15 minute mini-lectures (some of which are presented by the multimedia program itself), and cooperative activities in a "think-pair-share" format.</p> <p>In the multimedia program, students are encouraged to first inductively think about and develop concepts, then deductively apply the concepts to problems. The program contains "...frequent questions to get students engaged [with] incremental feedback..." The multimedia program is not only utilized in class to present mini-lectures and problems, but also to allow students to "preview and review" lessons. Each student has a copy of the program for their personal computer.</p> <p>While ideally this product would be used by the 1400+ freshmen engineering students taking statics annually, this engineering course is currently content-heavy and would not integrate active-learning type activities well without agreement or buy-in from faculty to sacrifice some content "coverage" in lieu of more student engagement. Engineering students can access the multimedia program on a CD, but it is not actively integrated into their statics sections.</p>

Project Label and Title	TC1-3, Technology Infusion.
Personnel	Joe Tront, Butch Nunnally, Dong Ha
Stated Goals or Needs Addressed	“Students were failing the course, and it is a gateway course that is used for CPE, CS, and EE’s, so there is considerable volume going through and there are I guess are lots of potential problems with differences in the way the course is taught and it’s kind of the doorway or the gatekeeper course, the first one that students encounter in the EE curriculum typically the CP curriculum.”

Funds Awarded	Stated Expenditures
\$18,000, year 8	GA’s

Project Activities
<p>The project involved gathering a team to "implement some modifications to courses, develop technology-based delivery mechanisms... technology presentations that would be common amongst all the people who teach it."</p> <p>Project staff developed shared notes to build consistency in teaching, and they have been working toward this goal: "...to place 600 questions on the web and make them interactive so as the student goes through and tests themselves on the questions, tries the questions, they will get some interaction and say well that is not the way you should have done it, this is the way you should have done it.”</p>

Project Label and Title	TC1-4, Multimedia Microelectronics.
Personnel	Robert Hendricks
Stated Goals or Needs Addressed	“get [the students] excited about material that they really mostly weren’t very interested in.... the students that were being addressed were primarily seniors in electrical engineering.... half of them tell you that (why are you) in EE and...the most common answer is not because I love electrical engineering, ...because I hate chemistry and this is a chemistry course. I have got this little mission in life to convince electrical engineers that it really is relevant being in EE that you want to understand something about how semi-conductors are made....”

Funds Awarded	Stated Expenditures
\$9,000, year 8	GA’s

Project Activities
<p>Materials developed for this project are used in a chemistry of microelectronics materials course taught out of the Materials Science department as a service course to students in the Electrical Engineering department. Materials were also adopted for students taking similar coursework in the Materials Science department.</p> <p>The instructor placed his handouts and Powerpoint presentations on the Web, so students could listen more intently during class without scrambling to take notes. Relevant class-related images were scanned for inclusion on the Web site. Originally, the materials were placed on a CD, until the Web emerged as the more viable option.</p> <p>Three CD's were created to describe gallium arsenide site manufacturing, silicon manufacturing, and fiber optic cable manufacturing. Students were involved in the development of these CD's over several semesters, taking site visits to plants, photographing operations, and writing the text content. As described, "...the students loved going to see a plant. They said it was far more interesting, they learned more about how a semiconductor manufacturing process worked by going down and seeing the Roanoke facility, writing a segment of it, photographing it, and having to describe in detail what they did, and the fact that I let them work in teams."</p>

Project Label and Title	TC2-1, Master Technology Teacher Training
Personnel	Joe Tront
Stated Goals or Needs Addressed	"The goals for that project were to get more faculty involved by providing workshops for them, by sending them to workshops if possible, and by helping make them so-called master teachers so they could come back on campus... and help train other faculty."

Funds Awarded	Stated Expenditures
\$8,000, year 8 \$8,000, year 9	computer lab equipment, student wages, faculty travel

Project Activities
<p>Workshops were held at Virginia Tech and faculty were sent to workshops outside the university at conferences such as ASEE. Workshops were attended by approximately 25 to 30 individuals from 10 to 12 departments. Technology workshop topics were diverse from java programming to "how to develop Powerpoint slides to how to use synchronized streaming media." Computer lab facilities in the New Engineering Building and faculty development labs in Torgersen Hall were utilized for the training.</p> <p>It was recommended that future training be leveraged with graduate assistant support or with close ties to engineering's Multimedia Lab, because the workshops "get the faculty members salivating and then once they do that, they need some help actually getting to the food... they need someone to do the production." Faculty members should be responsible for outlining content and providing materials, while graduate assistants can be utilized to "turn the crank."</p>

Project Label and Title	TC2-2, Comparing Internet-based Education Methods.
Personnel	Joe Tront
Stated Goals or Needs Addressed	“I think the desire to exchange experiences was a need there. The faculty needed to be convinced that these things are doable.”

Funds Awarded	Stated Expenditures
\$9,000, year 6	refreshments
\$9,000, year 7	
\$5,100, year 8	
\$4,000, year 9	

Project Activities
Informal conversations were held among engineers on development topics such as "javascript." Formal presentations were not delivered, rather, a leader who was knowledgeable about a topic was assigned to kick-off a discussion. Meetings were held in various departmental conference rooms, and advertised to the college via e-mail announcements.

Project Label and Title	TC2-3, Technology Production Assistance.
Personnel	Glenda Scales, Jason Lockhart
Stated Goals or Needs Addressed	Providing course materials and remediation materials online, allows students who lack certain prerequisites for courses to catch up and remain with the class. "Our goal was to create a Web presence for engineering courses ... so that students could see not only a course description, but examples of homework, also if there was some remediation that needed to be done ...get more information about that course." Also, to accomplish this goal, there is a need for "more service-based resources on campus to address walk-up needs of faculty."

Funds Awarded	Stated Expenditures
\$9,900, year 8 \$35,000, year 9	staff wages

Project Activities
<p>Web-based course modules were created for approximately five faculty members in Industrial Systems Engineering (ISE). Project staff wanted to create a prototype "course presence" for other faculty to emulate, consisting of "a course description, syllabus, examples of class lecture notes, homework assignments, and even examples of quizzes or exams."</p> <p>The developed course modules included such multimedia as streamed digital video, audio, and flash segments. Project staff addressed "instructional units that require a lot of remediation, trying to develop a Web-based application to address that remediation so that the students can, on their own, practice and get in touch with what the faculty member is going to be teaching before they come to the classroom so that they have a better understanding once they get there and can ask better questions and go more in depth."</p>

Project Label and Title	TC2-4, Technology Implementation & Assessment.
Personnel	Tim Pratt, Glenda Scales
Stated Goals or Needs Addressed	“The actual goals were to develop some multimedia presentations which would help people understand communication (systems), that was our objective. ...the need is with students coming into information technology and electrical engineering both without a strong background in communication systems...very few of them have a BS EE. ...they need a rapid course that they can take on their own, which will bring them up to speed in these areas.”

Funds Awarded	Stated Expenditures
\$10,000, year 9	staff wages

Project Activities
<p>“What we produced and this is mostly done in the multimedia lab, is some animated segments ... which demonstrate we are moving in a different direction on how a communication system works. ...to try to explain to people who don’t have an electrical engineering program how a communication system functions.” “...the text and the animation will eventually form a module which we can use for self-paced learning and on-line instruction.” “[the animator’s] background is computer illustration, computer animation of which he is very good, but of course he has no background ...in electrical engineering. Part of my time has been to teach him basically what he is now creating to teach other people....”</p>