

Extending Classrooms Over Electronic Bridges
by Laurie Sherrod, Barbara Weaver, William Park,
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Clemson Pilot Laptop Program by Laurie Sherrod

The Clemson University College of Engineering and Science began offering a pilot laptop program for freshmen in the fall of 1998. Approximately 100 students joined the 1998 program and around 125 new freshmen joined the program in 1999. In 2000, the program will be open to incoming freshmen with a major in the College of Engineering and Science or the College of Architecture, Arts and Humanities. We expect approximately 175 students to participate.

Students in this program have a high quality personal laptop computer that they use in their classes, their dorm rooms and their homes. They participate in special laptop classes that take place in wired classrooms with network access at each student desk. Incoming freshmen with majors in CES or AAH are sent notification of the program in the spring. Those who choose to participate attend a special orientation session during their normal freshman orientation. During this session, they are given their laptop course schedules. They are also given instructions on the ordering and receiving of their laptops as well as advice on such matters as security, insurance, and extras (backpacks, mice, printers, etc.). The software project load is explained and August workshops are scheduled for the purpose of configuring the laptops with software and drivers.

In the two days before classes begin in August, we host workshops in wired classrooms for laptop students. During these workshops, students receive project load CDs. They put the CD in their laptops and reboot. Seven minutes later, all of the software that they will need is installed on the laptop--cleaning everything they already had on there. We then walk them through putting in network settings and sending/receiving their first email. They are introduced to WebCT and the campus network. Additionally, we offer an extra workshop for the less experienced students who may need extra help in getting started.

In the first two years of the project, there have been special laptop sections of English, math, computer science, chemistry, physics, history and engineering. Students are block scheduled into those classes so students who do not have laptops cannot enroll. In 2000, classes will also be offered in speech and Spanish.

To facilitate support, we select a project machine each spring for the following fall. In 1998, the selected machine was a Dell Latitude CPi. In 1999, the selected machine was a very compatible Dell CPt. The 2000 machine will also be a Dell CPt. On-campus support and warranty repairs are available. Students with non-project machines are allowed to use them. However, because

of the level of support for the project machine and the attractive group pricing, most students do choose to use the project laptop.

In the first two years of the program students have reported many successes and a few disappointments. They love having the same computer all of the time--in their classrooms, in their dorm rooms, and at home on breaks. They become very attached to their laptops. Many of them never have any problems at all with their machines. However, some have had broken parts--probably due to the heavy load placed on them by having 18-year-old owners who take them everywhere. In those cases, we are able to repair them at our campus help desk where we stock spare parts and spare machines.

Another common problem with Windows based machines is that they will "overload" them with software such as games, music, utility programs, etc. and end up with registry problems. This problem is easily resolved by using the project load CD to refresh their computers--restoring their hard drives with all software and drivers. Students are usually able to back up their personal files on our campus network before doing this.

When the students are asked about their classes, they typically rave about their laptop English classes. In the first two years of the program, all students involved had majors in the College of Engineering and Science. These were students who typically do not enjoy English. However, nearly all of our laptop students said that they loved their laptop English classes. The laptop English professors were able to assign topics that involved technology and they enjoyed that much more than their previous English classes. They also enjoyed the creative projects that the English classes used. They did such things as learn to use the campus bus system, visit the S.C. Botanical Garden, help with a Habitat for Humanity house, participate in CommuniCon where they presented the results of their projects to the community, and collaborate with engineering and math classes.

The students also seemed to enjoy their laptop physics, chemistry, and engineering classes. The results in the computer science class were a bit mixed. The professor reported that some students enrolled in the class without proper preparation. During the first year, the students were less enthusiastic about their math classes. They struggled with the calculus software package we used. In the second year, the problems with that were successfully resolved by the math faculty.

During the planning phase for the first year, it was decided that a web based course tools package would be chosen for laptop classes. WebCT was selected and was installed on a new server. Training was offered for faculty members interested in using it. Some of the tools offered included online grade posting, grade book, quizzes, surveys, bulletin board, course notes, chat room, groups with file posting, and whiteboard. Soon faculty were putting up their own password protected full featured web sites. Since there would be no additional cost, WebCT was opened to any faculty in the university who wanted to use it.

The university has provided laptops to 10 needy students in each of the first two years. It is expected that in 2000, laptops will be provided to 10 needy CES students and 5 needy AAH students.

Overall, the pilot laptop program has been very well received by students and faculty. Students have enjoyed sharing the laptop experience within a relatively small group. Faculty have enjoyed learning new ways to teach using technology. We have learned a great deal in two years and gladly share our experiences with others contemplating a similar experience. More information can be found on our web site at <http://www.ces.clemson.edu/~laptop>.

Barbara Weaver joined Clemson University's English department in January 1996, where she currently teaches both laptop and traditional classes. The laptop courses she teaches are first-year composition and contemporary literature. Having worked as an information products designer and project leader for AT&T, she has a strong background in computer technology. She also has experience as a journalist and photographer. She received her Master of Arts in English with a double focus on professional writing and women's studies from Wright State University.

Integrating Technology with English Course Content by Barbara Weaver

Two years ago, spring 1998, I was invited to join selected faculty in the College of Engineering and Science Laptop Pilot Program. I was excited about working with some of the most visionary people on campus, but I was also anxious. I didn't know what I was going to do with my students or how I was going to do it. As I reflect on the last two years, I see that, by integrating technology with my English course content, I have successfully engaged my students and taught them more than I imagined possible.

Developing Assignments that Integrate Technology

I began preparing for fall 1998 classes in April. Weekly meetings with Bernadette Longo, another laptop English faculty member, and Bill Park, a laptop professor in engineering, gave us opportunities to brainstorm ideas and articulate why we teach, what we want to teach, and what our hopes and concerns were. Those early sessions helped me feel more comfortable because I knew I wasn't the only one who was anxious. We were all in the same boat and needed to work as a team to ensure success.

Over the summer, I attended training in WebCT, Collaborative Learning Environment (Clemson-developed network resource for every class on campus), Adobe Acrobat, and use of the smart podiums in the new classrooms. I spent many hours of private time just thinking about laptops in the classroom and my course content. I realized that, in addition to specific course content, I want my students to learn life skills, such as:

- Audience analysis and perspective (their own and others')
- Teamwork (as individual contributor and leader), project planning, task delegation, management, and scheduling
- Respect for the interdependence of disciplines and of nature and culture
- Communication (written, oral, and visual; diverse audiences, purposes, and media)
- Critical thinking and reading
- Community contributions and the Clemson experience

To integrate technology into my classroom and especially into the assignments, I knew I had to review my traditional practices. I asked myself the following questions:

Why paper? Could it be done electronically?

Why word processing? How else might the students express what they've learned?

Why am I the audience? Could someone else be the audience?

Why am I the teacher? Could someone else enhance my teaching and increase their learning?

Why meet in the classroom? Where might I teach better and they learn better?

By examining my answers to those questions, I was freed to move beyond the traditional boundaries of classroom teaching and to explore the many possibilities with other faculty and my students. Some of the successful laptop English assignments I've given have been cross-discipline projects that allowed the students to apply their written communication skills to projects in engineering and math. My laptop students have also worked collaboratively with Clemson University's carillon students, the student chapter of Habitat for Humanity, the S.C. Botanical Garden's Nature-Based Land Sculpture Program, and local high school students.

Composition I

One of the most successful assignments in English 101 was the first assignment I gave to the fall 1998 students. The concept I wanted to teach was perspective. But I also had other goals in mind that I wanted to incorporate: Clemson experience, nature, and technology. I had the students form teams of four and then together we rode the Clemson Area Transit to the S.C. Botanical Garden. Each team had to find one place where technology and nature collide. Then each student on the team chose a different perspective. From that individual vantagepoint, the students recorded their observations on the laptops and took a photo of their perspective. Back in the classroom, each individual wrote a descriptive essay based on his or her observations. After reviews and revisions, the students posted their papers and photos to their individual Webpages and then made links to their teammates' pages. We all enjoyed seeing a clearly illustrated example of how four people with the same goal can look at the same thing and see something different. Students even appreciated learning how to ride the transit system and finding a quiet place to study (the Garden).

Another successful assignment in English 101 focused on "Kew Gardens" by Virginia Woolf. For this fall 1999 assignment, the students used the 1928 edition of the short story that has illustrations by Vanessa Bell and one of their texts, *Visual Communication: A Writer's Guide* by Susan Hilligoss. We began by visiting the S.C. Botanical Garden to observe the activity in a garden and to try to identify with Woolf. They captured their observations on the laptops and in digital and print photos. Then using the Hilligoss text as their guide, they evaluated Bell's illustrations and presented their evaluations orally in class and in writing on the CLE. Then they selected a portion of text from "Kew Gardens" and designed a page/screen for the text and wrote a process and purpose paper in which they explained their process for developing the page and articulated their reasons for the decisions they made each step of the way. They were required to cite the Hilligoss text at least twice. The results from this project were a delightful surprise. As the students made decisions about their page design, their understanding of the selected text became much sharper. This assignment more than any other allowed me to see my students thinking critically and applying that new depth of knowledge to their work.

Due at the time of the final exam are two versions of the student's portfolio. The portfolio documents the student's academic achievements (not just English), employment, volunteer work, and extracurricular activities. The electronic versions are published on their Clemson University homepages. Occasionally, students will also burn it onto a CD. The printed versions are submitted in a three-ring binder that the students can use during interviews. My objective is to provide the students with an opportunity to create materials that will help them get internships, co-op positions, and after graduation, full-time permanent positions or acceptance into graduate school.

Composition II

The most exciting spring 1999 English 102 assignment focused on the S.C. Botanical Garden's Nature-Based Land Sculpture Program. Students attended lectures by the visiting artist; interviewed the artist, the Garden's cultural programs director, and a landscape architecture professor; researched rammed earth techniques and local history the artist needed; worked alongside the artist to help install the sculpture; and completed a writing assignment. Their writing assignment involved the following:

- Read and evaluate hometown newspaper
- Determine where in the newspaper an article on the sculpture program might be published
- Contact the editor of the paper
- Arrange for publication of the article (or write a letter to the editor)
- Write the article/letter
- Submit the article(with photos)/letter to the paper
- Submit published article/letter to me for additional points
- Present results at CommuniCon Spring 1999

Seven articles with photos and six letters to the editor published in 13 different newspapers in South Carolina, North Carolina, Georgia, Michigan, New York, Pennsylvania, Connecticut, resulted from the class of 20 students. Through the process, they learned many skills that involved their laptops: communicating with newspaper staff via email; conducting online research, maintaining an online records of their lecture notes, interview notes, and first-hand observations; writing/reviewing/revising their article/letter online, and scanning their article/letter for the electronic portfolio.

Contemporary Literature

The first time I taught the laptop section of contemporary literature, I used the same literature I had always used. The class was OK, but the students were not nearly as engaged in the reading as I had hoped. For spring 2000, I selected texts that I was fairly confident we could easily read through a science lens, in particular Chaos and Complexity theories. Russ Marion, author of *The Edge of Organization*, guest lectured two class periods. He gave a brief overview of the theories and provided examples to help make the theories more easily understood. This new approach to reading literature with engineering and science students has worked. They do not miss class and seem happy to be there, they contribute to in-class and bulletin board discussions, and they've convinced me through their reading quizzes that they are reading all the texts from start to finish. Some of them were so fascinated by our introduction to Chaos and Complexity theories that they've done additional research and posted their most interesting findings to the bulletin board.

Some are focusing their literary analysis paper on Chaos and Complexity theories in selected literature. To reinforce what they learned, I assigned a service learning project as a wrap-up of this portion of the semester. They worked in teams to develop and deliver to local AP English high school students a PowerPoint presentation they entitled, "Reading into Science: The Fusion of Literature and Technology." They also developed a Website where they and the high school students can continue to interact.

Conclusion

The Pilot Laptop Program has allowed me to develop a more effective way to teach English course content. My students and I use our laptops everyday to record and then share notes from class discussions; to find on the Internet immediate answers to questions that arise; to write individually and collaboratively; to assign, submit, and grade assignments; and to develop a better student/teacher relationship through increased contact. Where I used to lecture, my students and I now develop study guides together online. Everyday we explore, experiment, and learn together. Whether or not my laptop students are learning to be better writers than students in traditional English courses is difficult to assess. I can without any doubt report that my students are fully engaged in their assignments and have a keen desire to produce writing they are proud to publish on their Website and present to an authentic audience.

In addition to advanced degrees in electrical engineering, William Park has a BS in ornamental horticulture and was a cattle rancher for a few years. His current interests include fractal modeling of natural phenomena, experimental musical instruments, and xerophytic horticulture.

A Perspective from Engineering by William Park

Introduction

The laptop courses in engineering give the instructor options not available in standard classes. In addition to obviating inconveniences such as having to schedule computer lab time in advance, classes in which all students possess laptop computers allow different approaches to accomplishing the desired course goals. One of several goals in the two freshman engineering courses at Clemson is for the students to begin developing the ability to communicate technical information.

It is a standing joke that engineers (and engineering students) cannot construct a grammatically correct sentence. A cross-disciplinary project between Engineering and English involving the instruction of freshman engineering students was thus welcomed. This section of the paper will document the engineering specific aspects of this collaboration as well as observations made over the last four semesters.

Projects

There are two primary projects in the freshman engineering classes that have benefited from the collaboration with English.

Engineering Timeline

In ENGR 101, the first semester course "Introduction to Engineering," the students are divided into eight groups, each of which is to develop a web-based timeline of significant events in one

of the eight engineering disciplines offered at Clemson. This material is then reviewed, modified, and augmented by both engineering and non-engineering students under the supervision of the English faculty. Following the initial development of the timeline during the first semester of the program, ENGR 101 students in subsequent semesters begin with the material already online and add new material as well as improving the existing material. The intent is to create links to the timelines from the College of Engineering and Science Website for use as both an educational and recruiting tool.

Process paper

In both ENGR 101 and ENGR 120, the second semester course “Engineering Problem Solving and Design, the students are divided into teams, and each team must design, implement, and demonstrate several “mini-design” projects. As part of the final report, each team must develop a process paper. The goal of a process paper is to clearly document the design and construction of a mini-design project, so that someone with no knowledge of the project could duplicate the design from the information in the process paper. The engineering students were responsible for writing the process papers, and non-engineering students wrote critiques of the papers. The critiques were then used to guide the engineering students in subsequent revisions of their process papers.

How does it work?

A third project, introduced too late during the current semester to be included in the English schedules, should benefit in future semesters from the collaboration. Teams of students in ENGR 120 were assigned the task of developing a web page (or pages) describing how some device works in a fashion that can be understood by an intelligent 14 year old. Each team submits three candidate devices from which the professor chooses one. The devices range from the relatively simple (e.g. flush toilets or hot-air balloons) to the seriously complex (e.g. the Global Positioning System). In addition to suggesting that the students peruse recent issues of *Scientific American* magazine, which has a regular “Working Knowledge” feature, the professor provides feedback based on a preliminary version of their web page. In subsequent semesters, these will be part of the collaborative effort along with the timelines and process papers.

Results

Assessment

From the engineering perspective, the primary benefit of the collaboration has been a significant improvement in the quality of the written work submitted by the engineering students. Although we do not have any objective measures at this time, it is quite clear to the engineering faculty that the papers submitted by the students in the laptop pilot program are significantly better than those submitted by their peers in the traditional freshman engineering courses. The laptop students’ papers not only have fewer grammar and spelling errors, but also more importantly are more clearly written and address more fully the proper issues.

Assessment of the effects of the collaborative project on other freshman engineering course goals is very difficult due to the nature of those goals. Building teamwork skills, helping students determine if they wish to remain in engineering, and choosing a specific major if they do remain

are not easily quantifiable. The more objectively measurable goals, such as use of computational devices and software, are not directly involved in the collaborative projects.

Problems

The primary problems that have arisen in the collaborative projects have involved access to web servers. During the first year, we did not have a permanent home for the timelines, so the students used their personal web space provided by the university. Unfortunately, any such material disappears if the student is no longer enrolled. At the beginning of the second year, we established individual group folders on the college webserver with ftp access. However, due to human communication problems, access privileges to these folders disappeared for extended periods of time during the semester. Hopefully all such problems will be resolved before the third year of the program begins in August 2000.

Bill Moss is a Professor of Mathematical Sciences at Clemson University. He has a BS in Electrical Engineering from MIT and a Ph.D. in Mathematics from the University of Delaware. He has worked at Lockheed Aircraft, the Naval Nuclear Power School, Georgia Institute of Technology, Old Dominion University, and Clemson University. His research involves mathematical modeling including modeling fires in buildings. He is currently experimenting with student-centered, active learning methods supported by information technology.

Teaching Mathematical Sciences in the Laptop Program by Bill Moss

I am now at the end of my second semester of teaching sophomore ordinary differential equations in our laptop program. This is a course that I taught about a dozen times in traditional lecture mode between 1974 and 1990. I have taught the laptop section of this course in fall and spring semesters of the 1999-2000 academic year.

The clientele of sophomore ordinary differential equations is almost exclusively engineering majors. In discussions with engineering faculty over the years, a common refrain has been that engineering majors do not retain their first two years of undergraduate mathematics into their junior year and beyond. I can identify with these statements because I regularly teach advanced engineering mathematics to juniors, seniors, and first year graduate students. I struggle with the retention issue on a weekly basis in that course.

Through the NSF sponsored SUCCEED coalition of eight engineering colleges, I had the opportunity to participate in several faculty development workshops beginning in 1997. I learned about active learning, cooperative learning, Bloom's taxonomy of educational objectives, the cone of learning, learning styles, problem based learning, think-pair-share, one minute essays, and much more. I read several articles and books on the topic of effective teaching. Beginning in the fall of 1997, I cautiously moved away from the traditional lecture mode of mathematical instruction toward a student-centered mode of instruction. After a couple of semesters of experimentation, I began to wonder how effective my lectures had been in the past. An informal self-assessment suggested my lectures have not always been as effective as I thought. Based on student evaluations, I have been better than average at the traditional lecture mode of delivery: three 50 minute lectures per week, lots of examples worked in class, discussion periods, good

motivation by concrete examples, graded homework, hour exams, and a final exam. From a student perspective, I teach a good course, but the basis for comparison is other mathematics courses, all of which are delivered in lecture mode. Students have no way of knowing if there is a better way until they are exposed to one. The traditional lecture mode of delivery is a passive learning environment, which research has now shown is not conducive to long term retention.

I have designed a nontraditional sophomore differential equations course around seven key components: assessment based on instructional objectives, mathematical modeling, a workshop mode of delivery, laptop computers, a smart classroom, the mathematics application Maple, and the course management system WebCT.

Students are given instructional objectives for each unit of material so that they know exactly what they are expected to be able to do. The set of objectives for the course constitutes a framework on which the course is hung. Assessment is keyed to these objectives.

An applied mathematics course can be a “cookbook” of techniques that a student “may” need later on, or the mathematical content can be justified as necessary for modeling complex engineering systems. Historically, models drove the development of applied mathematics, not the other way round. It makes sense to start with models that are appropriate for sophomore engineering majors.

The workshop mode of delivery consists of one or two 10-15 minute mini-lectures centered around the Maple worksheet of the day, together with individual or group activities, which can include think-pair-share or one minute essays, but most often involve problem solving. It is possible to achieve a daily assessment of each student’s progress by looking over shoulders, and helping when needed. Software or hardware problems, or Maple problems are readily apparent.

My students and I have our laptops booted throughout each class. Students can download the Maple worksheet of the day before coming to class or at the beginning of class. Students annotate the worksheet of the day as it is discussed and then use it as a template in the problem solving sessions. All exams, graded homework, and projects are written as Maple worksheets and uploaded to the course WebCT site.

Our smart classrooms provide an instructor with a ceiling mounted LCD projector, together with an electronic lectern containing a sound system, laptop-LCD video connection, laptop network connection, built-in computer, VCR, video amplifier, and campus cable feed. Power and network connections are provided at the student tables. During the mini-lectures, I cycle back and forth between the blackboard and the projected worksheet.

A Maple worksheet can contain symbolic computation, numerical computation, and mathematical word processing using standard mathematical notation. Over the course of the semester, students accumulate a worksheet for each day’s class. In addition, their graded homework, exams, and project worksheets form a portfolio, which can be used as a reference for later work in engineering courses and beyond. These worksheets are expected to contain written explanations of problems and their solutions, graphics, and of course mathematical expressions in the Maple programming language.

The course management system WebCT is the communication hub for the course. In addition to course announcements, bulletin board, and e-mail, chat and whiteboard tools are provided. Student teams can communicate outside of class using these tools. While away at a conference, I recently held my office hour electronically. I can post or update worksheets and supplementary lecture notes anytime. Individual or team worksheets can be submitted to an electronic drop box and grades are available to students as soon as they are posted.

What is the student perspective? Students like the learning community that has built up around the laptop program. They like the fact that instructors and students are using the same environment, together. They say that the electronic communication makes them feel closer to the instructor. He's always there. They like the freedom to work anytime, anyplace, on or off campus and home for the holidays. They share with me the belief that their course portfolio will be a foundation for future work and that it is at least a partial solution to the retention problem.

Jacob Cartner is a first-year student at Clemson University. He is a member of the laptop pilot program and is majoring in Biosystems Engineering with a BioTechnology concentration. Jacob is from Greenville, SC and attended Eastside High School, where he was National Honor Society president and captain of the Varsity Basketball team. He is also a member of the National Society of Collegiate Scholars.

A Student's Perspective of English 101 Laptop by Jacob Cartner

Clemson University not only provides students the latest technological advancement opportunities, but also integrates those opportunities into a classroom learning environment. During the course of my first semester at Clemson, our English 101 class took advantage of such technology. I sincerely can say that Professor Weaver arranged a semester's work into a grand opportunity-- an opportunity to make the best of what is available to us. From web pages to in-class presentations, she made my English 101 experience a good one. She knows what elements are essential for engineers to acquire, and runs her classroom accordingly. Three of my favorite assignments fall semester were: our team taught "Technology in the Garden" PowerPoint presentation, our "Integration of Technology into the Classroom" presentation, and the development of an electronic portfolio.

One of our major projects this year was to analyze an essay by a notable environmental writer. We were put into groups and each group chose a specific essay that we felt pertained to our interests. Each team member wrote a summary of the essay. As a team we developed and delivered a PowerPoint presentation to teach other class members what the author of the essay was trying to convey. Our group chose John Muir's "Hetch-Hetchy Valley." After carefully reading the essay, summarizing it, and discussing it with other group members, we developed our PowerPoint presentation. Our group was able to pair up with another group in the class, whose essay refuted ours, and set up an in-class debate. This assignment taught me valuable communication skills and made me realize the level of teamwork that is necessary in developing a successful product. Technology was used to create our presentation and to show it to the class. But perhaps more important than all of that is, because our essay was concerned with the

preservation of the wild, I really began to ponder how humanity has altered nature. "Humanity's Destructive Hand" was a fitting title for our presentation because it showed the relation to this alteration. We must find somewhere between the realm of nature and of civilization so that we are happy. Civilization is humanity's scar on an innocent wilderness.

The "Integration of Technology into the Classroom" project was perhaps my favorite part of my English 101 experience. A Governor Hodges' appointee who is in charge of technology in South Carolina schools, a representative of the S.C. Commission on Higher Education, and a Clemson University assistant vice president came to visit our class. Our laptop class was chosen as the only class that they would visit, so we had to be well prepared. We decided as a class that we would put together a presentation that gives a brief overview of what we had been doing all semester. After choosing what would be contained in the content of our presentation, we set to work creating yet another PowerPoint presentation. Professor Weaver asked if I would help present it and I agreed to present the welcome, introduction, and conclusion, as well as to facilitate the question and answer session at the end. It was a great opportunity for me because I worked with Professor Weaver and other classmates outside of class to put it all together. It instilled in me many values, ranging from teamwork, to technology skills, to communication, but probably most important of all, it helped me gain comfort in presenting in front of an audience. In the end, I got to see how it all transpired, as a result of our planning, and I know that the governmental officials left impressed.

Another one of my favorite assignments this year, and which also gave me some of the most valuable skills, was the development of an electronic portfolio. After just a few classes of English 101, Professor Weaver stated that we would have a running web page that would contain all material that we would cover in our English class, examples from our other courses, explanations of our work experience, and information about our extracurricular activities. Our assignment was to document the knowledge, skills, and talents we are developing at college and later in our cooperative education positions or internships. One of our first homework assignments was to form this basic web page. Needless to say, I left that class session a little discomfited. I did not have much experience with computers, and had no experience in creating web pages, but I set to work. After experimenting with different composer software packages, I found that creating a web page was not as hard as it sounded. I began to enjoy designing this new creation that held my opinions and thoughts, unique to me. This ongoing project gave me a lifetime understanding of what it really means to be an engineer-- to invent something, whether a web page or a new type of bridge, and to work on improving that something in order to have the best outcome. Engineers experiment everyday in hopes of finding an alternate route, creating revised procedures, inventing a better device, or to develop a more efficient process.

The Pilot Laptop Program has been a great opportunity for me to develop an understanding of technology and how it is integrated into the realm of education. I have learned essential life skills: communication technology, written, oral and visual communication, teamwork, web page design and development, and much more. Corporations and businesses are depending more and more each day on computers. The future holds a world that relies on computer technology. The Laptop Program has helped me become comfortable with the latest advances, so that I will have that cutting edge when venturing out into the work force. Yet, at the same time, it has also

taught me to become aware of the consequences of such technology on the world we live in. People, without even realizing it, heap more and more hazard on our environment each day. It is said that old fashioned forms of communication, such as literature and written letters, will soon become obsolete, being engulfed in a overflowing sea of computer technology. I hope that we never find ourselves in such a grave state, but I often begin to wonder whether or not that statement is already beginning to occur.

Ryan Edward Keitzer is a first-year mechanical engineering student at Clemson University and a member of the College of Engineering and Science Pilot Laptop Program. He is from Fort Mill, South Carolina.

A Reflection on the Laptop Program by Ryan Keitzer

When I first started in Clemson University's Pilot Laptop Program, I wasn't really sure what to expect of it. I didn't even know if the laptop classes would have textbooks. At first I expected calculus to be the "main" laptop class, but within two weeks I learned otherwise. Instead, my English and engineering courses were where I was able to use my laptop most effectively. Both courses relied heavily on the use of our laptops in and out of class.

Once the semester was under way, and I had a chance to see what the laptop courses were like, I set some small goals for myself--goals that could be reached within the duration of the semester. My goals for English were to advance my written communication skills, to comfortably make the adjustment from high school level English to college level English, and to finally learn how to make a meaningful, effective, eye-appealing web page. For both semesters of first-year engineering we were asked to complete several mini-design projects that would give us a taste of engineering. My goals for engineering were to make sure that mechanical engineering is what I want to major in and to learn how to more effectively use the computer as a tool when doing extensive projects like the mini-design projects.

My goal to improve my written communication skills is a goal that I always have had when beginning any English course. I have always felt that if I didn't have that goal, I was wasting my time. I want to always be open to suggestions on how to improve my writing. In my English 101 laptop class, we were assigned a typical English 101 response essay. Ours was on "A Jury of Her Peers" by Susan Glaspell. This individual assignment allowed me to evaluate the way in which I write, and to finally learn how to properly use a reference in a paper. For English 101, we also had to write two summaries: one of "A Jury of Her Peers" and one of an essay on technology and nature for the section of the course called "Technology in the Garden." I had never been asked to summarize something in the professional sense. I quickly learned the proper format and discovered new ways to improve my general writing skills. Another type of writing assignment that I had never been faced with before was the "Kew Gardens" assignment, for which we had to design a page for selected text from "Kew Gardens" and then compose a process and purpose paper. The process and purpose paper was a big step for me. It taught me how to explain a series of steps within a professional paper, and how to articulate why I did certain things when making my design on the computer. One final thing that really assisted the completion of this goal was the in class discussions of the material being covered. The

discussions gave me the opportunity I needed to orally express my thoughts and feelings about a certain subject. Once those thoughts and feeling were let out, I was able to compose a more effective paper.

Another goal I had was to make a good adjustment from high school level English to college level English. Throughout my high school English courses, I was always given a specific topic to write about. The assignments were very vague and all seemed to be virtually the same assignment. This is where college level English is different. Each writing assignment was completely different, which is the way that I believe English should be taught. The different types of assignments gave me a chance to learn the different ways in which I can professionally express my opinion. One way of expressing my opinion that I had never thought of using in the classroom was the team developed and delivered Power Point presentation for the Technology in the Garden assignment. This was one of the more difficult assignments. It forced me to learn how to effectively use Power Point, improved my teamwork skills, taught me how to be a more critical reader, and helped me understand the interdependence of nature and technology. Overall the largest barrier that I had to get over between high school and college was the amount of work assigned. In high school I was assigned about one large project a semester, but now I have about five projects a week. In the long run all of this work will eventually pay off.

My last goal for English, and by far my largest, was to finally learn how to make a meaningful, effective, eye-appealing web page. In the past I have never had the opportunity, the resources, or the reason to make a web page. Thankfully two assignments, the *Cloud 9* assignment and the electronic portfolio assignment, forced us to make a web page. The first assignment, *Cloud 9*, was a group project, which allowed the group members to teach one another how to construct a working web page. This gave me the opportunity I needed to sit down with classmates and learn the basics to making a web page. Once I had the basics down, I was ready to make my own individual web page. The electronic portfolio assignment gave me a significant opportunity to make a fairly large website, which would contain all of my projects from the semester. The web page includes massive amounts of digital images and graphics, more than enough meaningful text, and an intricate web of internal and external links. Two of the assignments included in my web page involved composing an argumentative paper and transforming the ideas brought forth in that paper into a miniature web page. By doing this, my original ideas became more powerful by allowing a person to visually see what I think and how I feel and surf through my ideas in a web page environment. This assignment ultimately taught me how to effectively use technology to communicate my message to the rest of the world via the World Wide Web.

As for my engineering goals, I really wanted to try to learn how to use the computer in a way that I might be required to use it as an engineer. In our engineering classes, we had the opportunity to learn how to effectively use such programs as Matlab and Microsoft Excel. During the course of the year, I was also exposed to every discipline of engineering so that I could decide for myself which discipline I wanted to pursue. The mini-design projects that we were assigned brought together these ideas and many more. The projects were completed in groups, which taught us how to work together by exploring and evaluating several different ideas and to combine them into a single final project; just as we would be asked to do in the real world. In addition, the projects also gave us the opportunity to convey our ideas to the rest of the class through the computer applications that we learned how to use in class.

I have received more out of this program than I could have ever expected. My educational goals are being met or exceeded through the laptop program. We have done everything from building an actual living, breathing house to taking a majestic walk through the South Carolina Botanical Garden with our laptops and digital cameras in hand. I have learned more in one year at Clemson University than I did in all five of my high years combined; and I believe that the laptop program is the main reason for this. For the first time ever, English is my favorite course and I am receiving high marks.