

## **Cross-College Collaboration to Enhance Spanish Instruction and Learning**

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We report our pilot collaborative results for enhancing foreign language instruction and student learning by incorporation of an engineering laboratory component involving use, dissection, and discussion, in Spanish, of four modern consumer devices: compact disc player/burner, electric and acoustic guitar, internal combustion engine, and bicycle.

Our original lecture course, “Spanish: Language, Culture, Technology”, not only taught the structure inherent in an intermediate language class by integrating vocabulary, issues, and projects that are of special interest to technical students, but also integrated cultural and technical issues of our global society. The object was to enlist students’ technical enthusiasm for the process of learning a foreign language and studying international cultural and technological issues.

Our lab activity sequence of read, use, assemble, and discuss (in Spanish) is used to promote the use of the Spanish language in a real-world technological context. The lab modules are adapted to teach technology students vocabulary and modes of thought in their professions. We report how this modification allows students to enhance their reading, speaking, and writing skills in Spanish.

In particular, we survey how the lab component contributes to achievement of four of the six student learning objectives, namely that students will:

1. Learn vocabulary commonly used in engineering and technology context,
2. Develop the ability to comprehend and use Spanish in settings invariably encountered in our technological society
3. Interact in a more formal setting such as the presentation of a technological/culture project to class and guests, and
4. Explain in the target language the workings of a technological device.

We conclude with lessons learned and plans for a final version and institutionalization of this cross-college collaboration between engineering and foreign languages.

Course Design

*Spanish: Culture, Language, Technology (FLS 212)* was designed specifically to encourage engineers to study a foreign language. Components of the course were incorporated with just this end in mind. First, the prerequisite for the course was deliberately set at two years of high school Spanish: a level that would not intimidate prospective students. At the same time, this level of proficiency allowed the course to be taught at the intermediate level. Secondly, wireless laptop technology was integrated throughout the course, thereby appealing to engineers' interest in and love of technology. To make the original course even more attractive to engineers, it was designed to satisfy the science, technology, and society requirement in the College of Engineering. This was crucial, as the engineering curriculum is particularly tight. If the class didn't satisfy a College of Engineering requirement, many students might regard it as a luxury they could not afford. Finally, the class is offered as a prelude to a study abroad program, which includes lectures from visiting engineers and visits to technical sites in Spain.

For our new cross-college collaboration, a device dissection laboratory for common electronic and household devices was woven into the course. The following sections discuss the original Spanish course content and structure, the modification to allow inclusion of device dissection and related activities, and our assessment and evaluation of the pilot experience in cross-college collaboration.

### Original Course Content

FLS 212 utilizes not only the structure inherent in an intermediate language class by integrating vocabulary, issues, and projects that would be of special interest to the technical student, but also integrates cultural and technical issues in our global society. The object is to enlist the student's enthusiasm for technology in the process of learning a foreign language and studying international cultural and technological issues. In our global society, our students are acutely aware already of the professional value of the ability not only to speak a foreign language but to have a working knowledge of the technical language of their chosen profession.

What we want our students to learn: (italics indicate those original learning objectives which are assessed here with respect to enhancement by inclusion of the lab components)

- Students will master grammatical structures required in an intermediate Spanish class
- Students will communicate with newly learned structures in written and oral form
- *Students will learn vocabulary commonly used in engineering and technology contexts*
- *Students will develop the ability to comprehend and use Spanish in settings invariably encountered in our technological society*
- *Students will demonstrate an awareness and appreciation of target culture; will demonstrate understanding of guides to cultural and engineering sites and artifacts; will demonstrate an understanding of cultural and historic artifacts in the Hispanic world: Roman aqueducts, pyramids, castles, cathedrals and basic principles of architecture*

- *Students will interact in a more formal setting such as the presentation of a technological/cultural project to class and guests*

The original lecture course was already “engineering friendly”, having been created to serve this student group. In addition to the integration of technology topics into cultural and language contexts, the course involved substantial use of wireless laptops for research and homework, and included frequent reference to web-based materials such as Marshall Brains’ website: HowStuffWorks.com.

#### Modification of existing course

In the modified course, a non-engineer (Dr. Kennedy) teaches the language, and a two hour bi-weekly device dissection lab is added, in which students study the cultural importance of devices such as bicycles and guitars, read technical materials in Spanish, keep a notebook with labeled diagrams in Spanish and prepare an oral and written report to teach us what they have learned from the lab.

Following the outlines of the earlier product and process engineering laboratory course (Beaudoin and Ollis, 1995), students worked in teams of four. They began by researching the history and principles of their device, both in English and Spanish. They used the device to evaluate its functionality and disassemble and reassemble it to study its optics, mechanics, and circuit boards. Eventually, they presented their device to other students, in Spanish. Thus they furthered their knowledge of device, language, and culture. In doing so they derived all the benefits of the original course and also expanded their Spanish engineering vocabulary and develop their technical presentation skills in a language that is in fast becoming a necessity in our global community

#### Science, technology, society projects

All students completed two science, technology, and society projects. Working in teams of three and imitating the work in the device dissection laboratory, they studied an artifact of the Hispanic world. Their task was to research and describe the historical significance and engineering importance of the artifact and then to explain how the artifact reflects the culture which produced it. The fruits of these activities were two group presentations in the course of the semester –practicing the final methodology of the end project—and a group paper in English to summarize their project in Sevilla and in Milwaukee, two cities seemingly disparate in culture.

Each lab has material -specific guidelines for that particular period and a report to class, notebook completion, oral presentation and demonstration to class. The general guidelines for lab components were as follow:

The in-class group oral presentation (in Spanish) covered:

- 10 bulleted points on history of device and other introductory material
- 20 important vocabulary words in Spanish that all Engineers should know

- Description of purpose of lab, procedures, conclusions
- Graphics: important diagrams of lab work
- Show and tell: tools, parts, functioning of parts- in short, any demonstration that may help us to understand machine better
- Calculations: choose a problem and explain calculations and significance of problem

Written work which was to be handed in the day of oral presentation by each member of a group included:

- Notebook with diagrams and procedures- in Spanish if possible
- Calculations
- Short essay on cultural importance of this technology: how technology reflects time, place, and people

Students were encouraged to be creative in demonstrations and graphics presentations. Vocabulary explanations and handouts were always helpful. Power Point was used creatively by virtually all groups. .

An example of the technical vocabulary lists which students created is shown in Table 1 for the bicycle:

Table 1  
Spanish-English technical vocabulary for the Bicycle

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Barra: crossbar
Pedal: pedal
Cadena de transmisión: drive chain
Cable de freno: brake cable
Sillín: bicycle seat
Freno trasero: rear brake
El engranaje: gear
Las manillares: handlebars

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The words range from simple to more technical. When questioned at the end of the class about the usefulness of this vocabulary, most students responded that finding and using the technical vocabulary was more useful than the traditional vocabulary in the classic language course.

#### Lab reading

A laboratory notebook was provided for each device. The notebook contained technical descriptions and background for a device, as well as questions and short problems to encourage and test understanding. The notebook materials were created

originally for a first year laboratory for new engineering students. Thus the technical descriptions were very accessible, and suitable for adoption and translation into Spanish for the present class.

The instructor (Dr. Kennedy) took the lab materials and translated a few pages of introduction and history of the device. The first few lab steps were in Spanish including instructions on taking device apart, and the last few lab instructions were in English so the students could work from Spanish to English and English to Spanish. There were four activity labs and three calculation problems.

For the oral presentation, students described the lab process and explained the cultural importance of their device, imparted vocabulary which the whole class should know, and presented a calculation that was a part of the lab..

### Evaluation and Assessment

Evaluation and assessment activities were of two kinds: a written questionnaire to the students, addressing specifically the instructor’s student learning objectives for the course, and in-depth interviews via focus groups (students and TAs) and individual faculty (Drs. Kennedy and Ollis).

The student questionnaire results appear in Table 2, and those for the oral interviews in Table 3.

Table 2  
Survey Form and Responses:  
“Did the lab component enhance achievement of course learning objectives ? ”

Students: This brief survey explores the degree to which the addition of a ‘hands-on’ laboratory component to your course, “Spanish for Engineers: Language, Culture, Technology”, has enhanced the achievement of student learning objectives for the course. Four of the six objectives relate directly to the laboratory experience, and associated class reports. Please indicate your judgment as to the following objectives:

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Objective (below):	The laboratory component contributed to achievement of this objective:
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Students will:	Agree Agree Neutral Disagree Strongly
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Learn vocabulary commonly used

engineering and technology contexts	9	5	1	0
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Develop the ability to comprehend and use Spanish in settings encountered in our technological society	7	8	0	0
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Understand guides to cultural and engineering sites; understand cultural and historic importance of artifacts in Hispanic world: Roman aqueducts, cathedrals, castles, paintings, and basic principles of architecture	8	4	2	1
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Interact in a more formal setting such as Presentation of an engineering project	5	9	1	0
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The results of the course objectives survey in Table 2 demonstrate achievement of our primary objective: to show that a device dissection laboratory can enhance achievement of the learning objectives of a non-engineering course, in the present instance, the instruction of Spanish to engineering students. We note in particular that these objectives are those composed by faculty in colleges outside of engineering.

Table 3  
Summary of Assessment Data: Spanish for Engineers

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*Student Focus Group*

Things that worked to help them learn:

- Dr. Kennedy as a teacher (there were lots of positive comments about every aspect of her personality and teaching style)
- Learning Spanish vocabulary in the take-apart lab
- Being able to work at their own pace with their group
- Seeing how culture and technology are related
- Learning from the native speakers about the language and culture they are a part of

Challenges and barriers to their learning:

- Finding a time for the lab (June 2004 NSF funding meant that labs were added after closure of the formal fall semester schedules)

- Not knowing what to do in the beginning of the lab
- The different resources in the lab—some groups had many books and weren't sure what they needed to use, others didn't find much useful in the documentation
- Too much time was allocated so some students lost motivation

#### *TA Focus Group*

Things that worked for the students:

- Learning the Spanish vocabulary in the take-apart lab

Suggestions or changes they would recommend:

- Provide the TA's with some orientation. to help the TA's define a more formal role.
- Students didn't need as much time in the lab. Either shorten the lab or have each group take-apart two devices.
- Add peer evaluation and assessment of learning in the lab.

The interviews summarized in Table 3 provide suggestions and criticisms which we will use to improve and finalize the course in the next collaborative offering in fall of 2005. On the basis of these comments, the evaluation and instructional responses of the three authors are summarized below.

#### Evaluator recommendations (Dr. Brent)

- In the first lab session, have the TA's overview the devices in the lab and let students know what kinds of work will be involved with each device.
- Now that we have a better idea of how long activities will take for students, develop a schedule of lab activities with check points.
- Have each student group complete work on two devices and select one for the final presentation.
- Have the TA's develop (in consultation with Dr. Ollis and Dr. Kennedy) a brief quiz for the key ideas to be learned with each device to be administered after work on that device is completed.

#### Instructor responses to recommendations: Plans forward (Drs. Kennedy and Ollis)

The major change will be provision of formal training periods for the lab TAs. This will be instituted in Fall '05 offering. These changes will address the concerns indicated above, specifically, provision of formal lab roles for TAs, specific end of lab period technical questions, and addition of further technical materials and activities so that the full 2 hour period is used.

However, budget restrictions suggest that the lab may profit from a decreased, rather than increased, role for the TAs. In particular, the predominance of senior engineering students in the Spanish class may obviate the need for technical explanations from the assistants; rather, the latter may serve to maintain the laboratory devices, while

the self-paced instructional chapters for each device, as modified by the language instructor, will serve to inform and direct the student teams in the lab. Our student TAs are recruited from our NCSU University Scholars program, comprising approximately the top 10% of the student body. These assistants are paid hourly. With a scheduled lab of two hours bi-weekly, and adding one hour per week for lab maintenance, an example semester budget for the TA salary is  $(1 + 3 \text{ hrs}) / 2 \text{ wks} \times 7 \text{ biweekly periods/semester} \times \$12/\text{hr} \times 2 \text{ TAs/lab} = \$336/\text{semester}$ , of which half is paid by Scholars and half by foreign Languages. The lab component, once established by an engineering faculty member, is thus a remarkably inexpensive path to enhancement of language learning.

### Study abroad alternative

The original course is also offered as part of a study abroad program in Segovia, Spain. Here students take two courses: *Spanish: Language, Culture, and Technology* taught by a faculty member in the Department of Foreign Languages at NC State and *Spain: History and Culture* taught by a prominent art historian in Segovia. Their experience is enriched by site visits to wineries, engineering sites, museums etc. Visiting engineers give guest lectures and accompany the group on various site visits. The engineering element of the course is provided in part by visiting scholars from NC State. Both classes fulfill general education requirements in the College of Engineering. The opportunity to take Spanish: language, culture, and technology in Spain adds a richness and depth to the experience and students are immersed in the culture and the language. The hands-on experience of the take-apart lab is replaced by the visits to a series of technical sites.

### Conclusion

*Spanish: Language, Culture, and Technology* was designed to help prepare engineering students to work and succeed in our shrinking world, in which cultures and people are increasingly brought into contact. The integration of a formal laboratory experience provided a clear enhancement in attainment of four of the six student learning objectives. The next course offering will formalize TA training and deepen the lab activities to further increase the advantages of this cross-college collaboration. Courses such as this can help to better equip our engineers to compete in the global economy. This language and engineering collaboration model can be used in other language classes with Engineers and we may expand these exercises to include French, Portuguese, Arabic.

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### References.

Beaudoin, D. and Ollis, D., "A Product and Process Engineering Laboratory", *Journal of Engineering Education*, 1995.

## Biosketches

Ana Kennedy is a faculty member at NC State where she has taught for 14 years. She also serves as the coordinator of advising for the Dept. of Foreign Languages. She received her Ph.D. from Duke University in Spanish Golden Age Literature. Her areas of research include pedagogy, golden age literature, and student services,

David Ollis is Distinguished Professor of Chemical Engineering at NCSU. He has recently co-edited (with Kay Neeley, University of Virginia and Heinz Luegenbiehl, Rose-Hulman) the text "Liberal Education in Twenty-First Century Engineering," Peter Lang, publisher, New York, NY 2004.

Dr. Rebecca Brent is founder of Education Design, Inc, in Cary NC. She has taught in the College of Education at Eastern Carolina University prior to moving to Cary, where she has authored numerous engineering education publications with her husband, Richard Felder (NCSU professor emeritus)..