Int. J. Engng Ed. Vol. 24, No. 2, pp. 304–313, 2008
Printed in Great Britain.

0949-149X/91 $3.00+0.00

Addressing 'Engineering Solutions in Global and Societal Context' Through an Integrated Foreign Language Immersion Experience*

DAVID F. OLLIS[1], ANA KENNEDY[2], MONIQUE GRANGER[2], REBECCA BRENT[3]
[1] *Chemical and Biomolecular Engineering, North Carolina State University, Raleigh, NC 27695–7905, USA. E-mail: ollis@ncsu.edu*
[2] *Foreign Languages and Literatures, North Carolina State University, Raleigh, NC 27695–7905, USA.*
[3] *Education Designs, Inc, Cary, NC 27518, USA.*

The ABET EC 2000 criterion requiring that engineering graduates 'understand engineering solutions in global and societal context' has proved problematic to address, because most engineering faculty are neither trained in, nor enthusiastic about including, topics which are logically part of the larger view required of 'global and societal context'. We present here our experience in providing 'engineering solutions' in broader contexts, achieved through integration of lecture or laboratory in technology into a foreign language course. We have offered such integrations in three formats: (i) Technology cameos in English, set in a Spanish language course, (ii) Technology cameos in French, set in a French language course, and (iii) Device dissection lab activities executed as part of a Spanish course. We demonstrate that engineering/foreign language faculty collaboration within such integrated courses formats provides one potential path to introducing 'engineering solutions in global and societal contexts'.

Keywords: Societal context; foreign language; engineering solutions

INTRODUCTION

IF ENGINEERING STUDENTS are to understand 'engineering solutions in a global and societal context', such solutions need to find a placement of engineering topics within a larger field of instruction. Foreign language courses have in recent decades moved from providing grammar, reading and writing to courses integrating culture, history and language. We demonstrate integration of engineering cameo presentations and hands-on laboratory experiences into the flow of such already tri-disciplinary courses of language, culture and history. The opportunity which these augmentations afford is the placement of 'engineering solutions in a global and societal context', a learning objective of the ABET EC 2000 criteria [1].

The notion of combining technology and language is of course not new. European technical education has long included foreign language competencies, especially in English. On a French sabbatical in 1975, Prof. Ollis was asked to give several lectures in English to a French chemical reactor design class. When he asked what topics would be timely for the flow of the course, came the reply: 'Our students already know the material. They just need practice hearing it in a second language'. The intriguing notion here was the French view that technical topics were perfectly suitable vehicles for enhancing language instruction, in this earlier case, of aural and oral foreign language proficiency.

Today in Europe, masters programmes in computer science engineering may be taken in German or English at Freiburg [2], as can materials science in Portugal, Germany and Denmark [3], and conditions for some instructor hires include the ability to lecture in English as well as host country language [4]. At the undergraduate level, a corresponding emphasis on language exists, as illustrated by CPE-Lyon's compulsory study of two foreign languages within its engineering/chemistry curricula [5].

US engineering students have had summer immersion opportunities in non-English countries for some time. Another French language example is the recent CPE-Lyon programme [6] wherein this French engineering school imports American and other foreign undergraduate engineering/chemistry students, and provides a language immersion with parallel French instruction in language and science/engineering topics. The CPE instructors are of two formal disciplines: engineering and foreign languages. This collaborative French

* Accepted 25 December 2007.

model motivated our present NSF-sponsored 'cross-college' collaboration of engineering with foreign languages at NCSU.

Within the US, bilingual possibilities in engineering programmes are far fewer. A very visible example is the dual degree engineering/foreign language five-year International Engineering Program (IEP) of University of Rhode Island, now offered in German, French, Spanish and Chinese [7]. Iowa State has begun a similar model [8] titled 'Languages and Cultures for the Professions'.

The integration of foreign language instruction and disciplinary instruction within individual courses is rare. Two recent papers are encouraging. Language instructor Caldwell [9] discusses her experience integrating service learning into a Spanish language course, a logical association because the student service occurred in a pre-dominantly Hispanic community. Neville and Brigg [10] propose using problem-based learning (PBL) modules to place Spanish into a biological engineering curriculum

Our efforts have taken a broader approach, introducing not only integration of engineering and technology into foreign language course, but also via cross-college collaboration which integrates engineering faculty into the second language course. The following discussion summarizes our experiences with lecture cameos and lab exercises in intermediate foreign language instruction.

INTEGRATING ENGINEERING INTO FOREIGN LANGUAGE INSTRUCTION

When we move from technical instruction in foreign language to placement of 'engineering solutions in global and societal contexts', we require a more multi-disciplinary approach. Here we describe our experiences integrating engineering lecture cameos and lab modules into pre-existing, multi-disciplinary foreign language courses.

Our Spanish-engineering collaboration involved our engineering device dissection laboratory. Here, the assigned activities for senior engineering students in the Spanish class included lab procedures and questions in Spanish, conversations in the lab in Spanish and class presentations of lab results, again in Spanish. In parallel, engineering faculty lecture cameos (now in English) included evolution of the Spanish guitar (sound engineering) and two civil engineering examples: the Roman aqueduct at Segovia and a bridge design by Santiago Calatrava, a modern Spanish engineer-architect. The English technical cameos were always followed by a language instructor question-answer exchange with the students, all in Spanish (Kennedy [11]).

In a second illustration, a recent collaborative NCSU French language course for engineers integrates language, technology and culture. Here, the lingual development of French grammar and historical chronology of French culture is augmented with engineering cameos (now in French) presenting the Roman aqueduct of the Pont du Gard in southern France, the medieval industrial revolution introducing water-driven mills, the invention of programmed weaving by Jacquard (subsequently adapted by Babbage for computer development), and the later Industrial Revolution of ca 1750–1890 (Granger [12]).

Example A: Spanish with English technology cameos [11]

Several years ago, Dr Ana Kennedy developed an intermediate Spanish course 'Spanish: Language, Technology, and Culture'. Recruitment issues were solved by arranging for Science, Technology and Society (STS) credit, thereby satisfying a distribution requirement.

Dr Kennedy's original student learning objectives 4–7 are all items which potentially could be assisted by engineering lecture cameos and lab device activities.

Student learning objectives for 'Spanish for Engineers':

1) Students will master grammatical structures required in an intermediate Spanish class;
2) Students will communicate with newly learned structures in written and oral form;
3) Students will demonstrate an understanding of cultural and historic artifacts in the Hispanic world: Roman aqueducts, pyramids, castles, cathedrals and basic principles of architecture;
4) Learn vocabulary used in engineering and technology contexts;
5) Develop the ability to comprehend and use Spanish in settings encountered in our technological society;
6) Demonstrate understanding of guides to cultural and engineering sites and artifacts;
7) Interact in a more formal setting such as the presentation of a technological/cultural project to class.

Our first collaboration approach was use of technology cameo descriptions of technical achievements important in Spanish history: the Roman aqueducts, using the Spanish city of Segovia as an example; the Spanish guitar and its evolution in Hispanic cultures; and the bridges of modern Spanish architect Santiago Calatrava. These 'engineering solutions in societal contexts', represent achievements in the domains of water supply and military defense, of music and the arts, and of transportation infrastructure, respectively.

In this simplest example, Ollis presented cameo descriptions in English; Kennedy of Foreign Languages and Literatures then quizzed the class in Spanish regarding the cultural and historical importance of these technical artifacts [11].

Table 1. Assignments for engineering students in Spanish device lab [11]

Written (individual) work:
- Notebook with diagrams and procedures- in Spanish
- Calculations
- Short essay on cultural importance of this technology: how technology reflects time, place, and people

Oral (team) presentation in Spanish:
- 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
- Calculations: choose problem; explain calculations and significance

Example B: Spanish with device laboratory immersion

A deeper language experience occurred when our 'device dissection' laboratory [13], of the type pioneered by Sheri Sheppard [14], was partnered with Kennedy's lecture course: 'Spanish for Engineering: Language, Technology, and Culture' and taught immersion style. Here, laboratory instructions and background were translated into Spanish for the CD/DVD player, the guitar and the bicycle lab stations. Students were asked to converse in Spanish in all laboratory discussion, and to report lab results via Power Point oral presentations in Spanish. The students from two pilot offerings were predominantly seniors in engineering. Thus, their circumstances nicely called to mind the French response of 30 years ago: 'The students already know the material, they just need practice hearing it in a second language'. The laboratory-related exercises appear in Table 1.

The 'presentation of a technological/cultural project to the class', learning objective 7 of Dr Kennedy's. was achieved nicely by the presentation of team lab activities. An example presentation slide for the portable compact disc (CD) device compares this technology to its magnetic tape predecessor, and appears in Table 2.

Students were surveyed to obtain their opinions regarding the degree to which the laboratory component and associated oral presentations contributed to achievement of Dr Kennedy's learning objectives 4–7 above. The results shown in Table 3 indicate strong positive self-assessment by the students.

As an aside, recently proposed 'Fundamental Objectives of Engineering Instructional Laboratories' (Feisel and Peterson [15], Feisel and Rosa[16]) include the following three items:

1) Objective 5: Design: Design, build, or assemble a part, product, or system, including using specific methodologies, equipment or materials,
2) Objective 10: Communication: communicate effectively about laboratory work with a specific audience, both orally and in writing, at levels ranging from executive summaries to comprehensive technical reports.
3) Objective 11; Teamwork: Work effectively in teams, including structure individual and joint accountability, assign roles, responsibilities and tasks; . . . and integrate individual contributions into a final deliverable" (Feisel and Rosa [9])

Our integrative 'language & lab' activities not only support these particular objectives, but do so in a particular 'societal context'!

Example C: Spanish summer in Spain

A deeper immersion still in 'social context' is illustrated by Kennedy's 'Spanish: Language, Technology, and Culture' course when presented as half of a four week summer programme in Segovia, Spain. A local Spanish instructor provided a comparison course in Spanish history, allowing students a language immersion totaling six academic credits, i.e. that of a typical 'full load' for a summer semester.

This overseas format included day trips to see the Segovia Roman aqueduct itself, tour an

Table 2. Example slide for device (CD player) presentation in Spanish

El disco compacto vs. cintas:
* El tocadores de discos compactos se introdujeron en mil novecientos ochenta por las companies Sony y Philips.
* Discos compactos tienen características de audiofrecuencia superiores cuando se compara con discos fonograficas o cintas casetes. El sano produjo por un disco es major y mas claro que el sano de una cinta.
* Se puede tocar un CD en manera no sequencial (distinto a casete o cintas 8-track) y esto perrmite el usario escoger la seleccion.
* No hay degradacion del discos cuando se toca porque al CD es leido por rayo laser y no por proceso mecanico.

Table 3 [11]. Survey Responses: 'Spanish for Engineers: Language, Culture, Technology'

Learning objectives(below)	Assertion: The laboratory component contributed to achievement of this objective			
Students will:	Agree Strongly	Agree	Neutral	Disagree
Learn vocabulary commonly used engineering and technology contexts	9	5	1	0
Develop the ability to comprehend and use Spanish in settings encountered in our technological society	7	8	0	0
Demonstrate understanding of guides to cultural and engineering sites and artifacts	8	4	2	1
Interact in a more formal setting such as presentation of an engineering project	5	9	1	0

ongoing tunnel construction for a high speed train, with accompanying lecture by the site engineers (in Spanish), visit a local distillery, and participate in local technical activities with an artisan (musical instrument construction) and an architect (museum renovation). The installation of each student within a Spanish host family completed the total language immersion experience.

Example D: French: language, technology and culture

Monique Granger recently instituted a French language course (see Appendix for French syllabus) similar to the original Spanish lecture offering of Ana Kennedy. A difference was that the occasional engineering visitor, Dr Ollis, was passably fluent in French. This advantage allowed cameo presentations in French, describing Roman aqueducts and the Pont du Gard in Nimes (Lamouroux [17a,b]), the industrial revolutions of medieval (Gimpel [18]) and 19th century (Rioux [19], Reymond [20]) times, the programmable loom of Jacquard (Essinger [21]), and Jules Verne's science fiction. As the technical level of each topic was modest, we hear echo again of the phrase 'They already know the material, they just need to hear it in a second language', and now in historical and societal context as well.

Thus the Roman aqueduct system near Nimes containing the Pont du Gard is outlined, the utilization of water power in the first or medieval industrial revolution is surveyed and the scope of the 19th century industrial revolution is chronicled, including the arrival of fixed and mobile steam engines, automation (Jacquard's loom), public health progress (Pasteur and rabies vaccination) and photography (Daguerre and Niepce). The impact of technologies in French context is also naturally included in these cameos. For example, the later industrial revolution contributed strongly to generation of noise near factories, decline of opportunities for religious worship, and creation of social unrest illustrated with worker riots due to automation of weaving. Babbage's future adoption of Jacquard's punched cards automation mechanism to create the first computers presents a more 'global context' for Jacquard's engineering solution. Jules Verne's works, including *Vingt Mille Lieues sous Les Mers* (Twenty Thousand Leagues under the Sea) constitute the beginnings of science fiction [22].

Impact and context of engineering solutions

We offer a few slide examples from our engineering French cameos. Water powered mills in the medieval industrial revolution illustrate early mechanization of human and animal labour (Table 4) (lecture slides only in French; translations provided on right side).

Social contexts

Understanding technology impact requires understanding the context in which the technology exists. For example, the monastery was a site for iron making in medieval times [18].

In the context of medieval technical instruction, we find an example of a tough teacher attitude, where author Dondi writes of his illustrated mechanical calendar (Fig. 1) for predicting moving (not fixed) holidays:.

Si l'étudiant qui lit mon manuscrit ne comprend pas tout seul mon horloge, il perd son temps en continuant à etudier mon texte ([18], p. 150)	If the student who reads my text does not understand my clock all by himself, he wastes his time studying my book any further

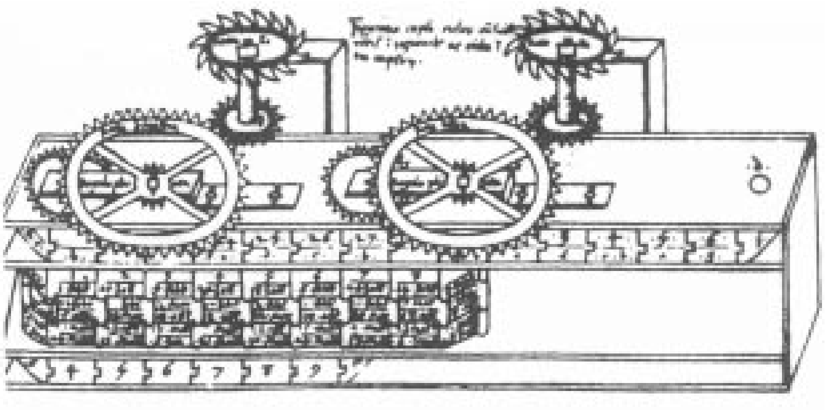
The arrival of the 19th century industrial revolution changed worker conditions dramatically, as illustrated here with impacts on both both length of workday and practice of religion:

Conditions de travail ([20] p. 121)	Working conditions
. . . aussi longtemps que l'éclairage ou la lumière du jour le permet, jusqu'à quinze ou seize heures par jour.	. . . as long as light of day or lighting allows, up to 15 or 16 hours per day
Sur le plan religieux, la continuité du travail, mettant les ouvriers dans l'impossibilité de pratiquer et d'observer les commandements, a contribué à la déchristianisation."	Concerning religion, this continuity of work placed the workers in a position from which it was impossible to practice and observe their religious commandments, thereby contributing to de-Christianization

The revolution's impact was felt throughout 19th century society, including in art of the time. Monet's painting, 'La Gare Saint-Lazare', illus-

Table 4. Impact of water power in the medieval industrial revolution [18]

Les ressources énergétiques de l'Europe pendant les XI, XII, et XIIIe siècles: L'énergie fluviale: Les moulins à eau:	Energy resources in Europe during the 11th–13th centuries were flowing waters, harnessed for water mills
Ecraser le grain	Crushing of grain
Tamiser la farine	Sifting of flour
Fouler le drap	Fulling of cloth
Tanner les peaux	Tanning of hides
L'arbre à cames	With the addition of a camshaft:
Mécanisation vs. à la main ou au pied	Mechanization via hand/foot power
Moulin à foulon (1086)	Fulling mill
Moulin à tan (1138)	Tanning bark mill
Moulin à fer (1197)	Iron mill
Moulin à moutarde (1251)	Mustard mill
Moulins à papier (1276)	Paper mill
En Chine 290 avant JC: décortiquer le riz	In China, 290BC: dehulling of rice



Dessin de Dondi. Mécanisme du calendrier des fêtes mobiles.

Fig. 1. Mechanical calendar for predicting fixed holidays

trated his early admiration for development of the steam train. Reymond [20] writes of this icon:

Symbole de la revolution industrielle naissante, le chemin de fer se developpe en France a partir des annees 1820. Longtemps considere comme une curiosite, un 'jouet' salon Thiers, il devient sous le Second Empire un nouveau, prodigieux moyen de transport.	Symbol of the dawning industrial revolution, the train developed in France after the 1820s. Long considered a curiosity, a 'toy' of the Thiers salon, under the Second Empire it became a new, stupendous means of transport.

Given the novelty of such integrated (foreign language)-(engineering) instructional pairings in the US, we present the entire the French syllabus in the Appendix. This organization style, developed first by A. Kennedy and adopted by M. Granger for their individual courses, makes heavy use of the Web for both language and technology highlights. We hope it may provide a useful guide for other foreign language instructors who desire to integrate more engineering and technology into their courses.

REFLECTIONS

Even minor involvement of an engineering faculty member in foreign language instruction may represent a kind of role modeling of the engineering profession. This notion we have not yet assessed. In particular, the possible influence which arises when an engineering professor uses the second language to explain technology may motivate engineering students to see second language proficiency as a professional, as well as cultural and literary tool.

Engineering design instructors may be better attuned than their other engineering brethren to show engineering solutions in the larger social and cultural contexts of present and earlier times. They are thus logically among the most promising candidates for recruitment into such cross-college involvements.

Finally, through co-presenting lectures with foreign language faculty, engineering faculty themselves may come to appreciate more fully the influence of 'engineering solutions in a global and societal context'.

Languages for specific purposes: Is LSP the next wave?

> In recent years, enrollment in German classes at American universities has fallen drastically. Excepted from this unfortunate trend, however have been programs that are devoted to teaching Languages for Specific Purposes (LSP), most prominently in the areas of business German and German for science and technology (Cothran [23], von Reinhart [24]).

The Spanish and French examples presented here for our 'Language, Technology and Culture' courses appear to fall into the 'Language for Specific Purpose' category discussed within the language instruction community. These latter practitioners could provide a rich source for future recruitment to and evaluation of such integrated, collaborative language courses.

Table 5. Multi-style approaches to foreign language instruction [25]

- Motivate learning: . . . teach new material in the context of situations to which the students can relate in terms of the personal and career experiences, past and anticipated
- Balance structured teaching approaches that emphasize formal training with more open-ended unstructured activities that emphasize conversation and cultural contexts of the target languages
- Make liberal use of visuals. Use photographs, drawings, sketches, and cartoons to illustrate and reinforce the meaning of vocabulary words
- Give students the option of cooperating on at least some homework assignments (active).
- Balance inductive and deductive presentations of course material.

Learning styles and pathways to language teaching

Our central proposition is that engineering students' learning of a second language may be enhanced when engineering faculty collaborate with foreign language instructors. The collaborative realizations presented in this paper are consistent with foreign language multi-style instruction techniques recommended by Felder and Henriques [17], the most relevant of which are indicated in Table 5.

Our several collaborations discussed here contain all the characteristics enumerated in Table 5, and should therefore constitute efficient educational vehicles for foreign language delivery. The positive, if informal, self-assessment by students (Table 3) also endorses our formats. We are encouraged to think that this cross-college collaborative instruction may be a model for convenient, national delivery of 'engineering solutions in a societal and global context', and thus assist US faculty in fulfilling the problematic ABET EC 2000 criterion.

Administrative advantages with faculty integration

Our integrative approach offers several administrative advantages:

- Simplicity: Foreign language instruction has increasingly been framed in the context of introducing foreign culture and history in parallel to language development. Thus such courses naturally provide illustrations of 'societal and global' contexts. If technological achievements are introduced at appropriate times in the flow of such courses, then the opportunity to present 'engineering solutions in societal and global contexts' is easily realized.
- Strength: Existing foreign language and engineering faculty are involved by lecturing and demonstrating materials in their respective fields, thus playing from their instructional strengths, not weaknesses. No new faculty training or certification is required; the engineer serves at the request of the foreign language instructor in charge.
- Support for ABET 2000: Our faculty collaborative delivery provides engineering students with exposure to the problematic EC 2000 'societal context' criterion while at the same time addressing their foreign language/humanities/social science requirements.

Scaling up to other languages

In this involvement of engineering faculty in cameos and device labs for language instruction, is potential for exploitation of an under-utilized resource: the approximately 20 per cent of US engineering faculty who are foreign born in a non-English culture, as well as other, native-born faculty who have become second language proficient. For example, at NCSU (and likely elsewhere), we find engineering faculty who are, collectively, fluent not only in French, Spanish, German and Italian, but also in the more problematic languages such as Chinese, Korean, Hindi and Arabic. Their recruitment and involvement in such collaborative language offerings could allow broad progress in addressing 'engineering solutions in global and societal contexts' throughout our engineering school.

Dissemination and adoption at other campuses

The transfer to other institutions of these language instruction models integrating engineering solutions into language and cultural contexts seems eminently plausible, since the ABET criterion under discussion provides a nationwide motivation for engineering faculty everywhere to collaborate with their foreign language peers. We are arranging permanent web site installation for the French course (for url see [12]), and expect to have the Spanish and a developing German version available on the Web as well. Both paper and web resources provide rich inventories of yet additional language materials which may be used by language and engineering faculty nationally to help deliver, for any culture . . .' the broad education necessary to understand the impact of engineering solutions in a global & societal context'.

Acknowledgement—This work was funded by the National Science Foundation (NSF DTS grant, award #0427904).

REFERENCES

1. ABET EC 2000 accreditation criteria.
2. http://www.learn4good.com/great_universities/engineering_computer_science_university-degree.htm
3. http://www.tuhn.edu/eclu-gs/pro_joint_mat.html
4. Michael Wald, private communication, 2007.
5. http://www.cpe.fr/fr2/gb/student/default.html
6. A. Wilson and D. Ollis, A Summer Engineering Immersion Experience in French, ASEE proceedings (2000).
7. http://www.uri/edu/iep/
8. http://www.language.iastate.edu/lcp/
9. W. Caldwell, Taking Spanish outside the box: A model for integrating service learning into foreign language study, *Foreign Language Annals*, **40**(3), 2007, pp. 463–471.
10. D. O. Neville and D. W. Britt, A problem-based learning approach to integrating foreign language into engineering, *Foreign Language Annals*, **40**(2), 2007, 226–246.

11. A. Kennedy, D. Ollis and R. Brent, Cross-College Collaboration to Enhance Spanish Instruction and Learning, ASEE proceedings (2005).
12. Granger website: http://social.chass.ncsu.edu/~mhgrange/
13. D. Beaudoin and D. Ollis, A Product and Process Engineering Laboratory for Freshmen. *J. Eng. Educ.* July, 1995, pp. 279–284.
14. S. Sheppard, Mechanical dissection: An experience in how things work, *Proc. Eng. Educ.: Curriculum Innovation and Integration*, Santa Barbara, CA (1992).
15. L. Feisel and F. D. Peterson,A Colloquy on Learning Objectives for Engineering Educational Laboratories, ASEE proceedings (2002).
16. L. D. Feisel and R. Rosa, The Role of the Laboratory in Undergraduate Engineering Education, *J. Eng. Educ*. 2005, pp. 121–130.
17. (a) C. Lamouroux and F. Garrigues, L'aqueduc du pont du Gard, Les Presses du Languedoc, Montpelier (1999). (b) http://perso.orange.fr/gilbert.lamouroux
18. J. Gimpel, *La revolution industrielle du Moyen Age*, Editions du Seuil, Paris (1975, 2002).
19. L. Rioux, *La Revolution Industrielle, 1780–1880*, Seuil, Paris (1971).
20. R. Reymond, *Le XIX Siecle: 1815–1914*, Editions de Seuil, Paris (1974).
21. J. Essinger, *Jacquard's Web*, Oxford University Press, Oxford (2004).
22. V. Blake, Introduction to *Twenty Thousand Leagues under the Sea*, J. Verne, Barnes & Nobel Classics, Fine Creative Media, Inc, NY (2005). Recent French version: J. Verne, *Vingt Mille Lieues sous les Mers*, Biobliotheque Hachete, Hachette Livre, Paris (2001).
23. B. F. Cothran and A. K. Grambert, Business German: The Next Step, the Birth of a New Discipline, Die Unterrichtspraxis/Teaching German 33.2 (2000), pp, 148–171.
24. W. von Reinhardt, W. German for Science and Technology: Teaching Strategies for Beginning Students, *Unterrictspraxis/Teaching German,* **34**(2), 2001, pp. 119–132.
25. R. M. Felder and F. R. Henriques., Learning and Teaching Styles in Foreign and Second Language Education, *Foreign Language Annals*, **28**, 1995, pp. 21–31.

APPENDIX

Syllabus for French 212: Language, Culture and Technology
(website: http://social.chass.ncsu.edu/~mhgrange/)
(Granger[3])

FRENCH: LANGUAGE, CULTURE AND TECHNOLOGY
This course of Intermediate French offers a cross-disciplinary approach to foreign language instruction. Not only will it teach the language structure at an intermediate level by integrating vocabulary, topics, and projects related to scientific and technological fields, but it will also emphasize the mutual relationships between Science & Technology and Society & Culture. The object is to enlist the student's interest in science and technology in the process of learning a foreign language and being aware of different perspectives on current cultural and technological issues in our global world. By an extensive use of the Internet, the course will provide an enhanced educational experience, involving faculty and resources from both foreign languages and technical fields, as well as external contributions. It will ultimately help students to communicate about their professional work in a larger global and technological context and to boost their career opportunities.

PREREQUISITES:
Successful completion of FLF 102 or FLF 110, or two years of high school French. This course has been designed for students in the Colleges of Engineering, Textiles, Management but is also open to any student simply interested in science and technology, with the instructor's permission.

STS General Education Requirement (GER) OBJECTIVES:
1. Develop an understanding of the mutual relationships between science or technology and societies, including the effects of or the effects on cultures, values, industries, governments, or other facets of those societies.
2. Develop an ability to critically evaluate information regarding these mutual relationships, recognizing that the information may come from a variety of sources and perspectives.

STS GER LEARNING OUTCOMES:
By the end of the semester, students will be able to:
1. Demonstrate reading comprehension of selected French texts about issues of science and technology
2. Describe major artifacts, inventions and discoveries in French civilization from the Gallo-Roman period to the twenty-first century
3. Analyze the impact of these technological or scientific innovations on society at various points in history
4. Explain the evolution of French society and the building of cultural values through these inventions and discoveries

5. Identify the most recent achievements of France in science and technology and the orientations of the French administration in terms of policies, regulations and priorities
6. Compare and contrast the various perspectives of the United States and France or the European Union on selected contemporary global issues
7. Discuss cultural and technological challenges of the present and future by critically evaluating the different points of view and priorities towards resolution

TEXTS & RESOURCES:
– A votre tour! Valette & Valette, D.C. Heath, 2006 ($75)
– Mystères et Merveilles des Sciences, avec liens Internet, P. Clarke, Usborne, 2005 ($25)
– Optional: Les Grandes Inventions, Gilles Vaugeois, Les Clés de la Connaissance, Nathan, 2003 ($30)
– Online subscription to French magazine Science et Vie Junior: http://www.scienceetviejunior.fr/index.php
– Francophone TV Channel: http://www.tv5.org/TV5Site/programmes/accueil_continent.php

MATERIAL ON RESERVE (D.H. HILL LIBRARY): (for use in projects)
– Le Visuel, Dictionnaire thématique français-anglais, Québec-Amérique
– Au Coeur des Machines, John Owen, Nathan, Les Clés de la Connaissance
– Les Grandes Inventions, John Owen, Nathan, Les Clés de la Connaissance
– Encyclopédie des Sciences, Google & Gallimard Jeunesse
– Les Grandes Inventions de l'Humanité, M. Rival, Larousse
– Le Monde des Sciences, Deux Coqs
– Les Aventuriers de l'Energie
– Comment la Terre devint ronde, J. P. Maury, Découvertes Gallimard Sciences
– Le Livre du Ciel, J. P. Verdet, Découverte Cadet-Gallimard
– La Tour de M. Eiffel
– Magazines Science et Vie Junior

PROJECTS & ORAL PRESENTATIONS:
Students will choose three projects on scientific or technological subjects related to their profession or field of interest and will present their research to the class in French using illustrations and sketches (Power Point or overhead). They will include the technical vocabulary and the cultural implications relevant to their topic, and will hand out a written preparatory questionnaire.

VIDEOS: Students will also be required to watch two videos on current French achievements in science or technology or new French laws, regulations and policies. One at least will address current international issues emerging from our global and technological world. They will submit a one-page, typed commentary in English, analyzing and comparing the different perspectives of the European Union and the United States on the same issue.

SEMESTER SCHEDULE: MWF 1:30–2:20

AVT = A Votre Tour
R = Reference Section (AVT: p. 421, R1–R37)
MMS = Mystères et Merveilles des Sciences

Week 1: Review

Vocabulary: free time, food AVT 6–9
Grammar: the present tense, articles and agreement of adjectives R 6, 7, 11 & 24
Culture: French-speaking countries AVT 11 & R 36–37
Workshop Science/Technology: Physics MMS 8, Les états de la matière (adjectives).
Chemistry in the saucepan: Le secret de la mayonnaise, Les blancs en neige

Weeks 2 & 3: Unit 1 (Every Day Life).

Vocabulary: physical description, parts of the body, clothing, health AVT 36–53
Grammar: reflexive verbs, expressions with «avoir» R 12–13, 20–21
Culture: Impressionism & Industrial Revolution AVT 60–65. Influence of photography (Daguerre), electricity, movies (The Lumière Brothers), optics (Fresnel) & colors (Chevreul).
Workshops Science/Technology:
Biology, Textile Industry, Medicine, Optics, Photography, Movies.
MMS 46–47 et 74, Pourquoi les objets sont-ils vus en couleur? Bis

Pasteur: pasteurization & vaccination. The Jacquard's loom: the ancestor of the computer.
Composition 1: portrait of a French scientist.

Weeks 4 & 5: Unit 2 (Being Useful).

Vocabulary: at home, how to describe an object AVT 74–91
Grammar: the subjunctive, relative pronouns R 21, 26 & AVT & 354–357
Culture: History of France from the gallo-roman period to the Middle Ages: the builders.
AVT 98–107. «L'histoire de France à travers ses châteaux» AVT 147. Castles: Châteaux.
Workshops Science/Technology: Architecture, Hydraulics, Civil Engineering.
MMS 28–37 (choose 1 material), 82–85. Images mystère (Science et Vie Junior)
Guided tour: North Carolina Museum of Art: from Roman sculpture to Impressionism.
Quiz 1

Week 6: Outreach, Projects & Exam 1

Project 1: describe a French artifact and its relationships with society.
Le Pont du Gard, le Viaduc de Millau (animation & video), amphitheaters,
les châteaux forts, Romanesque churches & cathédrales gothiques.
The Eiffel Tower & the World Fairs: La Tour Eiffel.
Impressionism and the painting of pollution (steam train, steamboats, smoke, factories . . .).
Monet: la Gare Saint-Lazare, Les couleurs de Monet
Guests: Alcatel/ Tekelec: Telecommunications; College of Engineering (Civil Eng.)
Exam 1

Weeks 7 & 8: Unit 3 (I love Nature!).

Vocabulary: vacation, how to describe an event, weather forecast, ecology AVT 112–132
Grammar:past tenses: the passé composé and the imparfait R4–5
Culture: History of France from the Renaissance to the 18th century. AVT 140–141
The Renaissance: a different world view (Copernicus, Galileo), the printing press, discoverers (C. Colomb, J. Cartier . . .), anatomy (Vésale, Vinci), surgery (A. Paré) . . .
Workshops Science/Technology: Anatomy, Astronomy, Meteorology, Ecology, Energy.
The steam engine (Papin, Carnot), atmospheric pressure & calculator (Pascal) . . .
MMS 40–41. Les flocons de neige. La foudre 1 2 3.
Composition 2: describe a French (past) discovery or invention and its influence on society.

Weeks 9 & 10: Unit 4 (Shopping)

Vocabulary: how to buy something, to fix an object (TV, computer, camera) AVT 151–165
Grammar: object pronouns, "y" & "en" R 8–9
Culture: French and Francophone music AVT 176–182
Workshops Science/Technology: Electronics, Computer Science, radio and television equipment, household electrical appliances, music. MMS 72–73, 78–79.
L'ordinateur. Comment ça marche. Histoire de l'informatique. Electronique.
Video/Commentary: French current events or achievements in science and technology.
Quiz 2

Week 11: Outreach, Project & Exam 2

Project 2: Current technological advances in France (Energy, Transportation, Environment).
Les éoliennes. Les énergies renouvelables. Loi (French law/plastic bags).
The TGV (high-speed train) & the Eurotunnel. The Concorde & the Airbus A 380.
Guest: French researcher in Environment; College of Engineering
Exam 2

Weeks 12 & 13: Unit 5 (Travelling)

Vocabulary: going on a trip, at the train station, at the airport AVT 190–199
Grammar: prepositions before place names, the future tense R 14–15, AVT 201–205
Culture: The European Union: Map E.U.
Workshops Science/Technology: Transportation
The bicycle & the Tour de France (Video). The Montgolfière (The Montgolfier Brothers),

The Car Industry: Musée de l'automobile de Mulhouse. Le métro parisien.
Airbus 380 (Video). Shipyard: The France & Queen Mary 2 liners.
Film/Questions: *Au Revoir, les Enfants.*
Quiz 3

Weeks 14 & 15: Future, Project 3, Review

Culture: the 20th century and the two World Wars AVT 252. The 21st century & the future.
Workshops Science/Technology: Communications, Military (Mirage), nuclear energy . . . MMS 86–91
Project 3: Sciences of the future & their impact on society.
Genetics: Les OGM. Le clonage (chart & animation).
Robots: Asimo, le robot humanoïde
Aerospace science: Ariane (rocket), Base aérospatiale de Kourou.
Nuclear energy production: Centre de Cadarache.
Les nanotechnologies. La réalité virtuelle, etc . . .

Review of the Final Exam.

David Ollis is Distinguished Professor of Chemical and Biomolecular Engineering at NCSU. He has 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. With Nick Serpone (Concordia University), he translated *Photochemical Technology* (Wiley Interscience, 1991) from the original French version.

Ana Kennedy has taught at NC State University for 15 years. She also has served as coordinator of advising for the Department of Foreign Languages and Literatures. She received her Ph.D. from Duke University in Spanish Golden Age Literature. Her areas of research have included pedagogy, golden age literature and student services.

Monique Granger has degrees in French Literature, Law, and Business. She was Principal and President of Ecole Francaise de Raleigh, a private French school in North Carolina (1996–2003). At NCSU, she has taught multiple levels of French courses in civilization and culture, written communication, conversation, and business communication.

Rebecca Brent is president of Education Designs, Inc., a consulting firm located in Cary, North Carolina. She is a faculty development and evaluation consultant for the College of Engineering at North Carolina State University and co-director of the National Effective Teaching Institute sponsored by the American Society for Engineering Education. She received her BA from Millsaps College in Jackson, MS, her M.Ed. from Mississippi State University and her Ed.D. from Auburn University.