

## **AC 2007-1623: PILOT COLLABORATION AND PROGRAM DEVELOPMENT: ENGINEERING SENIOR DESIGN AND SPANISH FOR CROSS-DISCIPLINARY LITERACY**

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## **Pilot Collaboration and Program Development: Engineering Senior Design and Spanish for Cross- Disciplinary Literacy**

### Introduction

Modern language scholars have begun in recent years to challenge educators to develop a framework for language that, as noted by Heidi Byrnes in the *Association of Departments of Foreign Language Bulletin*, “intimately relates knowing [the language] to diverse ways of knowing” (Byrnes, 11). [1] In proposing *literacy* as a framework for advanced second language acquisition, Byrnes also challenges language educators to link educational decisions to societal demands and to educate young people for the “undisputed complexity of human meaning making in and through language.” (14). As Byrnes makes clear, moving toward a socio-culturally grounded, genre-based literacy “locates language use in the context of social practice and meaning-making across disciplinary boundaries” (13). Language proficiency efforts, intercultural communication competencies, and service learning initiatives have all combined to foster a new praxis of language use that allows for a more critical rethinking of disciplinary boundaries, beyond the purely verbal or grammatical, and toward more transformational cultural and intercultural literacies. Within this theoretical framework, the pedagogical experiment we describe here is an example of an educational praxis that may point beyond language learning per se, toward the acquisition of other ways of knowing and learning. The purpose of this study is a) to present a workable example of cross-disciplinary literacy-based language acquisition pedagogy for intermediate to advanced students of language within the context of a technological university, and b) to describe a unique pilot collaboration undertaken at Michigan Technological University in spring 2006 between students enrolled in Civil and Environmental Engineering International Senior Design and Humanities’ Spanish for Special Literacies. Through the framework of technical and cultural translation, students engaged in the practice of professional communication and heightened their awareness of the socio-cultural context in which all communication, including engineering communication, is embedded.

### Background

When we first described our modern language efforts at curriculum design within the specific context of Michigan Technological University (*The Canadian Modern Language Review*) [2], the position of the Modern Language Program within our Department of Humanities was viewed as ambivalent or marginal because the science

and engineering disciplines that ultimately drive the University curriculum remain at the forefront of administrative priorities. Fortunately, modern language study at Michigan Technological University (hereafter MTU) is no longer a “vague notion.” The collaboration of modern language and engineering faculty has begun to acquire the tone of a more integrated pedagogy, one that would allow modern language and engineering faculty to more fully contribute to the mission of a technological university in the 21<sup>st</sup> century. This mission, as recently outlined by an MIT consortium of educators during the Colloquium on International Education held at the University of Rhode Island, November 2-5, 2006, is multi-focused: to strengthen international engineering education with emphasis on the global community, through inclusion of social, intercultural, and sustainable development goals, in conjunction with the technical and practical demands of a competitive global economy. Several schools or departments at MTU are steadily working to apply the professional skills of their faculty and students to sustainable development in less-developed countries. For example, the School of Forest Resources and Environmental Sciences has a Master’s International Program through which students do one year of course work in residence at the university, then serve two years in the Peace Corps, and finally return to the university to complete their master’s degree. The Department of Civil and Environmental Engineering (CEE) now offers two such programs, in its International Sustainable Engineering Initiative. The Department of Geological and Mining Engineering and Sciences, and the Department of Education have added similar programs. A fifth Master’s International Program in Rhetoric and Technical Communication (within the Department of Humanities) is currently under review. These university-wide and departmental commitments to international education, along with the creation of the minor in Spanish in 2001, have translated into increasing demand for Spanish language study in both cultural and pragmatic applications.

#### Literacy as a Framework for Advancing Language Acquisition across Disciplines

The absence of a university-wide modern language requirement, and the role of modern languages in our non-departmentalized program are crucial factors in defining how we are perceived by the university community. Our service ties to other departments, programs and institutions beyond the Department of Humanities and the university have long shaped that perception. Expanding demands for students to become *literate* about scientific, technological, and socio-cultural content, continue to impact the ways in which Spanish faculty view their teaching and research. These factors, including increasing opportunities for interdisciplinary and cross-disciplinary initiatives, have all fostered the development of what might be termed a Spanish language “literacy matrix,” with more and more Spanish Language and Culture courses at MTU poised to enhance students’ critically important awareness of how language in specific cultural and social contexts functions.

Language literacy collaborations at MTU were first spearheaded in 1993 between faculty in Geology and Geological Engineering (Bill Rose) and Humanities (Ciro Sandoval). Advanced Spanish for Special Literacies courses developed from efforts to place Spanish language teaching and learning at the service of the engineering and

science disciplines, within the context of a technological university. This was also accomplished with the understanding that engineers are also social actors in an increasingly interdependent world. Some of the classes taught included topics related to development projects in industrialized and non-industrialized regions, ecology and environment, and the cultural perception of natural hazards and risk, specifically in the area of volcanology. Workshops in specific developing regions and on specific volcanoes such as the Santa Maria in Guatemala, as well as other field trips for study and assessment of hazards and risk in El Salvador have made it possible for students to come in contact with authorities and officials from local educational institutions in these countries. This contact has fostered greater communicative competence across diverse disciplines, including journalism, education, and rhetoric and technical communication. These early initiatives also provided the opportunity for Latin American professional counterparts and students to pursue further study at MTU. The present Master's International Peace Corps initiatives grew from these early literacy efforts, also supported by grants from the National Science Foundation (NSF) and the United States Agency for International Development (USAID). Subsequent efforts and programs continue to respond to the need for students to become not only competent and effective communicators, but also culturally affective (sensitive).

The desire to renew and expand curricular offerings, to integrate with new disciplines and discourses, to create or redefine new fields, including technical and cultural translation, have begun to prompt a new paradigm in modern language, one that underscores the interrelations among language use, meaning, and cultural context, as well as the need “for learning to be attentive to language, to its figures and rhetorical devices” (Nelly Furman, 2) [3]. By *literacy*, we mean the ability to use language as a means of acquiring and communicating knowledge in/about a given reality in a given specific context. As Janet Swaffar and Katherine Arens explain with particular reference to modern language literacy: “Literacy describes what empowers individuals to enter societies: to derive, generate, communicate, and validate knowledge and experience; to exercise expressive capacities to engage others in shared cognitive, social, and moral projects, and to exercise such agency with an identity that is recognized by others” (2) [4]. Thus cross-disciplinary language *literacy*, as opposed to “language for special purpose,” places emphasis on value and motivation, on students’ active participation, and on multiple knowledges—specific as well as broad—acquired in the process of cross-cultural communication.

Spanish language faculty are finding increasing opportunities for cross-disciplinary collaborations beyond the Department of Humanities. Unsuspected links between seemingly unrelated fields offer new ways of communicating knowledge in business, science, and engineering. These links urge students, teachers, and other experts to see cultures, disciplines, and the roles they themselves may play in relation to culture, communication and engineering differently. Rather than see language as a fixed and static code, target-language literacy focuses on the meaning potentialities of language in use, and the infinite possibility for creative communication within specific socio-cultural contexts. Within these contexts, intercultural speakers of Spanish learn to mediate appropriate social interaction and action between different perspectives, cultures, and

their social actors. Spanish-speaking engineers, for example—those working across cultural borders—not only transmit knowledge in a specific intercultural environment; they also mediate knowledge between persons in the intercultural environment. The goal of the language and culture literacy class, therefore, is not only to help students develop appropriate strategies for coping in a foreign environment, but also to equip them with the appropriate strategies for mediating their own praxis or practice of intercultural communication: capable of constructing new literacies, literacies enacted, for example, from efforts to bridge old literacies and new illiteracies (i.e. technological inefficiency in non-industrialized cultural environments). Students, in other words, need acquire a “multiplier capacity.” In doing so, they become *multiplicadores*, “multipliers,” or disseminators of cognitive as well as affective knowledge among individuals, across classrooms, disciplines, agencies, industries, professions, and communities. As they progress towards becoming *affective* as well as effective cultural mediators and ambassadors, students acquire an understanding of how a language other than their own produces and distributes knowledge within socio-cultural communicative frameworks. As we learned in the spring of 2006, the piloting of a unique collaboration between Civil and Environmental Engineering and Humanities provided a forum for generating further reflection on the benefits of cross-disciplinary efforts for both students and faculty. We discovered, for example, that cross-disciplinary literacy as a framework for advancing language acquisition and engineering service learning also encouraged language and non-engineering students to integrate an international field experience into their educational career goals, further promoting the opportunity to see themselves as *multiplicadores* or affective multipliers across diverse borders.

#### International Senior Design and Spanish for Cross-disciplinary Literacy

Unique to MTU, the CEE’s International Sustainable Engineering Initiative trains engineers “to value community service and to prepare for the international marketplace” (University International Sustainable Engineering Initiative, 1). Through the Master’s International and International Senior Design Programs, CEE seniors and graduate students have worked in 17 countries, including Belize, Bolivia, the Dominican Republic, Honduras, and Panama. The motivational framework for the initiative is the UN Millennium Development Goals, an ambitious agenda for reducing poverty, improving lives and changing the way engineers are educated to “play a critical role in the eradication of global poverty and hunger, [in] facilitation of sustainable technology, beneficial infrastructure, and [in] promotion of change that is environmentally and socially just” (4).

Central to the CEE’s International Sustainable Initiative is the International Senior Design Program (ISD), directed by Linda Phillips in the Civil and Environmental Engineering Program. The Program allows students to perform various engineering design and construction projects in developing world communities. Since its beginnings in 2001, 118 students have participated. It is considered a leading program, among the most respected engineering service learning programs in the country. Information and comments are available at the web site: <http://www.cee.mtu.edu/projects/comments>.

In the summer of 2005, 23 engineering students worked with local residents in Santa Cruz, Bolivia. Eight design teams proposed design solutions for two city storm drainage projects, a feasibility study of land use options for a wetland, waste water projects for four overcrowded government schools, and structural analysis for a proposed building. After the two-week field experience, student teams produced an engineering study (in English) evaluating feasible solutions and preparing contract documents for their recommended options. These design projects (ISD reports) were then presented to the university community and the public at an International Senior Design Symposium held each year in the fall at MTU. Language and study abroad opportunities attached to the International Senior Design Program allow students who participate in these projects broader venues for practical experience and knowledge of both language and intercultural communication.

### Pilot Collaboration, Logistics and Composition

The pilot collaboration began in the fall of 2005 between two faculty members: Linda Phillips in Civil and Environmental Engineering and Sandra Boschetto-Sandoval in Humanities (Spanish Language and Culture). Students in Spanish for Special Literacies were “contracted” to “extrapolate most pertinent information, summarize and appropriately translate the [ISD] report into an 8-10 page document, to be understood by city officials, city engineers and school directors/parent organizations in Santa Cruz, Bolivia.” The “Request for Proposal to Provide Translation Service for Eight (8) ISD Design Engineering Projects” set corporate parameters for the class and the subsequent translation project assignments for the Spanish “Empresa de Traducción” [Translation Service]. The purpose of the corporate model for our collaboration served overtly to establish genre-based tasks that would enhance students’ critically important awareness of Spanish language in use in global engineering practices. Though variation exists in the definition of genre—in this case the engineering ISD report—a key characteristic, as highlighted by Vijai K. Bahtia, is that genres reflect disciplinary cultures and focus on “conventionalized communicative events embedded within disciplinary or professional practices” (23) [5]. Thus, while engineering faculty saw the project/course oriented to a specific purpose or [business] product—the ISD report translation in condensed form—Spanish language faculty saw the use of translation as a framework for advancing specific literacies across disciplines through the use of Spanish. We recognized a broader series of “communicative events” attached to the specific course register.

Twenty-four students enrolled in the Spanish course, and twenty-three students were assigned final grades. Students with differing levels of language preparation were surveyed in the second week (**Appendix A**). All MTU entering students with prior language background are tested prior to beginning fall semester, and most students place into either high beginner or lower intermediate levels of Spanish language and culture. Three (3) first-year students placed directly into the pilot course. Six (6) first-year students enrolled in the pilot after completing the Spanish Transitional (high beginner) class in fall semester. Eight (8) first-year students had already completed one intermediate level Spanish course at our university. The remaining six (6) students had already completed three or more university Spanish classes, including our Topics in

Hispanic Literature and Advanced Spanish for Special Literacies. The vast majority of students, while primarily only first-year university students, had already completed between three and five years of formal instruction in Spanish (including high school). Two thirds of the students had traveled to Spanish-speaking countries for brief periods; one student had lived abroad for an extended period, and three students had never traveled outside the United States. The overall background and participant age varied widely as well, from one specially enrolled high school student to a graduate student completing a Geology Master's International Peace Corps degree.

Data collected from a preliminary survey conducted in the second week of class indicated that students majors' also varied widely (**Appendix B**), with a substantial majority (8) of Engineering majors (Mechanical, Chemical, Electrical, Environmental, and Civil). Surprisingly, the class was composed primarily of non-engineering students from twelve different fields, including Biology (4), Scientific and Technical Communication [Humanities] (2), Geology (1), Psychology (1), Math (1), Chemistry (1), Business (1), and Construction Management (1). This unique student composition presented both challenges and advantages. The absence in the course of students in the Civil and Environmental Engineering field, and the fact that the instructor of the class herself could not claim to be an expert in a project of this scope mandated that field "experts," and consultants from beyond the class play a crucial role in bringing the project to successful fruition. Students would have to translate and negotiate their technical and technological knowledge(s) with others both in and beyond the class. At the same time, the fact that most of the students were from non-engineering fields also contributed to the creation of a framework of expectation of general and focused knowledges that could be pooled to guide the students' first reading and translation of the project text. Without sufficient prior specialization in reading Civil or Environmental Engineering texts, students would find it more difficult to lean on "correct" interpretations of the ISD report. Rather they would need to bridge their lack of expertise by pooling their resources, systematizing and comparing textual data in meaningful patterns, consulting with the "experts," and eventually generating readings [meanings] of their own. Rather than feel restricted to the completion of a product, students and instructor were challenged to engage in a process-oriented pedagogy that would motivate students to acquire familiarity with a specific engineering discourse, technocult, or system of meaning-making. When students acquire both a knowledge of meaning systems and an ability to negotiate those systems within different cultural contexts, they gain, what Tony Schirato and Susan Yell define as "cultural literacy" (11) [6].

Students who initially enrolled in the pilot course were motivated primarily by the desire to a) perfect their knowledge of written and spoken Spanish; b) learn more about intercultural communication in the context of living and working in different Hispanic cultures; and c) complete requirements toward the completion of a Minor in Spanish. Less prioritized objectives included: a) practice with technical and business vocabulary and b) the acquisition of knowledge about civil engineering design through the use of Spanish. Since the defining objective of the course was the translation of the ISD report, students were also asked to respond to a series of Spanish statements to provide faculty

mentors with an overview of the class, and to determine the preliminary linguistic and cultural preparation of each student regarding the project. Students were cautiously confident about their grammar preparation, as well as their comprehension of written and technical Spanish. Students expressed strong agreement about the importance of working in groups with class peers, “consultants,” and professors in order to accomplish the project. They recognized that engineering projects have social and ethical impacts, and that sustainability—a slippery term to define, depending on whether one defines it from the perspective of the developing or developed regions—is important to all projects related to engineering. Faculty mentors may proceed, of course, on the premise that if a given community is able to maintain the project through sustained infrastructural (economic, environmental, and governmental) support, then the project is ethically sustainable. This premise, we learned, is difficult to process within the logistical time constraints of the class—namely without more history, and fewer verbs!

Students believed that they would learn from the Bolivian people affected by the environmental problems presented in the ISD reports; and shared the belief that experience with the translation project would help them find a job after graduation. Students also shared strong agreement in their desire to see the projects completed not only in class but in Bolivia as well. While students were doubtful as to whether they had much to teach the Bolivian clients, there was very strong agreement that the translation project would help or even “save” many people. Surprisingly, their self-confidence and technological optimism were tempered by their uncertainty as to whether the U.S. lifestyle is the best, and the realization that contradiction can arise in trying to proffer solutions for real world, real life problems. Despite their relative sophistication concerning issues of translation, they seemed naively unaware of how issues of gender and class work to complicate daily life for people in Latin America.

#### Course Format, Project Objectives and Tasks

The class met for approximately 70 minutes, twice a week, for fourteen (14) weeks. Students were assigned a detailed syllabus (in English), on which they were quizzed in Spanish at the end of the first week of class. After a preliminary assessment and mutual agreement, eight (8) team leaders were selected by the instructor early in the second week, and groups of no more than three (3) students “enlisted” with the team leader of their choice. Once the teams formed, a *sorteo* (drawing) was held to distribute the individual projects. Students were provided with a separate handout describing the ISD translation project in detail: its goals and objectives, member and team leader responsibilities, deadlines and formats for class presentations, final drafts, and project evaluation and grading. Finally, students were informed in writing that their completed reports would be delivered to the ISD “clients” in Santa Cruz, Bolivia by the engineering professor in person. The multifaceted project goals were outlined on the project description as follows:

- To provide experience with “real life” problems relating to an area of the developing world considered one of the poorest in Latin America.



- To provide direct experience with technical (engineering) translation from English to Spanish
- To create an awareness of the unique identity of Bolivia, and of the historical, political, social, and cultural context from which the engineering problems (and solutions) arise.
- To help students incorporate linguistic, humanistic, social, cultural and intercultural perspectives into technical working analysis and decision making
- To provide students a relevant forum from which to develop both oral and writing skills in Spanish.

Given the difficulty in finding appropriate level engineering textbooks in Spanish in our remote area (Western Upper Peninsula of Michigan), special dictionaries, handouts, relevant primary texts, and vocabulary lists were prepared in advance. We began by assembling a six-page bilingual list of pertinent technical civil and environmental engineering vocabulary related to the projects. Vocabulary was also indexed from the English ISD reports. Translations were checked against various technical dictionaries and internet sources, and revised with the help of technical experts and consultants in the field. Technical, economic, historical and cultural internet resources were also provided. A unique addition was the incorporation of excerpts from a seventh grade Bolivian social studies textbook (*Sociedad 7*) [7], a Bolivian school student's personal gift to the engineering professor. The readings and *proyectos de aula* (class projects) from this primary source text were discussed in class as a direct window into the historical, social, and cultural fabric of the people the ISD projects were intended to impact. Especially intriguing to the students were the notions of community (*pueblo*), nation, and country (*patria*), along with the translation of the UN Universal Declaration of Human Rights (1948) that the social studies reader incorporated. While our students initially recognized the concept of *patriotismo* (patriotism) from their own standpoint, they soon realized that the Bolivians' translation of the term differed in tone and substance. As one student noted, "I never knew I could be patriotic simply by being a good student and serving society" ( ref. in *Sociedad 7*, 125). The easily accessible Spanish and detailed illustration of the historical events that culminated in Bolivia's colonial dependency, political instability, and economic stagnation provided a good platform for class discussion, particularly for locating language use in the context of historical and social practice. The grammatical support text (*Metas comunicativas para negocios: Spanish for Business Purposes* [McGraw-Hill, 1998]) provided the grammatical review that also sustained the project throughout the semester, along with intercultural concepts and vocabulary helpful to students in preparing the ISD glossaries attached to each of the translated ISD summaries.

Mandatory use of Spanish in the classroom and constant assignment revision anchored the teaching methodology to student expectations and performance. If students are to understand the project as process-oriented, it is important to provide a mechanism that allows students to scaffold their attainments and capacities, and to measure their improvements. As students revised their work, they were encouraged to constantly ask questions, to use responses of surprise and puzzlement as avenues to exploration, to pay

attention to their own communication and that of others in all its dimensions, and thus to focus on the process, as well as on individual desired outcomes. To encourage this mindfulness, students were allowed to revise all their work for additional credit. The ISD report condensing and translating process was closely tied to the revision process. Without prompt and consistent instructor and consultant feedback, students are unable to benefit from the revision process. Logistically, of course, this revision process is a demanding aspect of the course for both students and instructor. But students also champion the procedure because they are aware that the revision affords them greater practice with form and content, and greater opportunity for process learning. As one student commented, “The most valuable portion of this project was being able to make changes on the draft in a very productive order. First, there were corrections that made grammatical sense of the [document] and constructed whole sentences. Then, the next draft was corrected to create a fluent and intelligent document. The last draft, then, dealt with technicalities of choosing the culturally appropriate concept, or the verb that best described a certain action. It helped me better understand the material to not have all the changes thrown at me at once.” “[W]orking over the same project multiple times,” said another student, “allowed us time to first be familiar with the subject and then allowed for analyzing the best ways to present the information.”

Students prepared two MSPowerPoint report presentations of their project in Spanish. Presentation of the first report draft in weeks six, seven and eight incorporated a brief analysis of the country map, work site, and a commentary on the political, economic, and social conditions impacting the engineering design project. Students needed to be mindful of their classmates as the principal audience. Presentation of the second report draft in weeks ten, eleven, and twelve shifted the audience perspective to the Bolivian “clients,” including Bolivian engineers, students and their parents, local officials, contractors, and workers who would construct the project. As they “translated” their initial written project draft to a verbal and visual register, students were engaged in critical reflection; they adjusted to new information and thought processes, and displayed awareness of more than one standpoint (audience) perspective. Students were held responsible for different portions of their presentation, with emphasis on individual improvement in the second presentation. In the end, however, the presentations were weighted heavily for group effort. While constantly testing their cognitive flexibility and practicing their oral and written skills, the MSPowerPoint class presentations also informed a multiplicity of other registers, attitudes, and awareness, including tolerance for ambiguity, affective (as well as cognitive) intercultural competence, and behavioral flexibility, all important in the process of becoming intercultural speakers and *multiplicadores*.

Following the corporate model, written project drafts that accompanied the presentations were also subject to rigid deadlines. While the first two drafts were attached to the oral presentation power point materials, revisions leading to the final draft required timeliness and discipline. Most students wrote and submitted between three and five drafts overall—*with* consultants in the modern language lab, *for* the ISD team members, *to* other faculty consultants, and to the instructor before submitting their final version in both hard copy and electronic format.

## Translation as a Framework for Multiple Literacies

The ISD report translation structured the linguistic and conceptual frameworks of communication with which students were able to build their own discourse capacities in a reflective, substantive fashion. If English is indeed the technical *lingua franca* of global communication, students were constantly reminded that such status can be exclusionary as well as illusive. The ISD project translation served as the anchor for a series of related sub-tasks, including summary and synthesis of the ISD report, themselves forms of translation. Students were advised to set limits to linguistic innovation, which could avoid the risk of introducing dictionary-based infelicities. Reading tasks were defined to begin to identify the overall significance of textual details and the language used to express those details as tokens in the text's larger pattern (topology) of technological and socio-cultural meaning.

Setting content parameters for translation was another way to help students tackle the length of the ISD report. This template involved determining various parts of the translated text, with special attention to the description of the project, the engineering or construction problem, the methods used to assess the problem, the solution, and the final recommendations. In learning to first read the English text for meaning with help from the ISD team members, students acquired technical "expertise" which they shared with their peers and the instructor in class as mediators (*multiplicadores*). Unlike a literary text, the ISD report actually proved more accessible to students. It was more redundant, having more than one point at which readers could access it (including illustrations, titles, restatements, and the like). Also, the ISD report is organized around concrete situations rather than abstract principles.

As students began translating their work, they realized that translation, like reading, is a process of reconstruction. As they worked to revise their work, focused on rendering the text readable, they saw the dangers of relying too strictly on dictionaries and glossaries, as well as on machine translations on the internet. As the class pooled its knowledge on septic systems, for example, speculating about a probable translation, they realized that dictionary correctness may not apply even in technical translations once words are put in discourse contexts. The more consideration given to a word in different contexts (*morder* vs *picar* [for mosquitos in a drainage canal) or *ofrecer* vs. *brindar* [for greater effect in an introductory "business" cover letter]), the greater the likelihood of varied retention in the student's Spanish language repertoire. While most students learned to "not perform a literal translation," the use of collaborative technical translation as a framework for oral and written practice in Spanish helped students acquire other knowledge, including an understanding of perspective and audience, cultural sensitivity, and a greater (self)consciousness about language as a tool for meaning-making. Several student comments reflected this new literacy. As they reconstructed the ISD report, students realized they were translating more than mere words and verb forms. Consistency in point of view, coherence, text layout on a page (including the use of subsections), the use of diagrams, maps, charts and other illustrations made the text more accessible as a system of information, not just a system of language. As one

student succinctly described the process, “[T]he project felt most valuable when I would read the English description of a possible solution that lacked a descriptive drawing. Having to figure out how exactly the system worked, and then explain it in Spanish really worked my brain! Finding ways to translate concepts, not just single words, into Spanish was very helpful in my understanding of the Spanish language.” This process clarifies how communication can be understood as the practice of producing meaning, and the ways in which systems of meaning are negotiated by participants in a culture.

Student teams also collaborated in preparing glossaries for each translated ISD report. The purpose of the glossaries in Spanish encouraged students to practice circumlocution and/or meta-communication, an important exercise in expanding vocabulary and its retention. The development of glossaries also helped students focus on the message to be conveyed to an “other” (foreign) audience, stressing facility in comprehension and understanding for the particular receiving audience. Several students devised illustrations to accompany their print definition not only for greater clarity but for appropriateness. One of the defining characteristics of intercultural communication competence—a complex phenomenon encompassing multiple components—as specified by Alvino F. Fantini at the School for International Training in Brattleboro, Vermont—is the ability to perform effectively and *appropriately* when interacting with those who are linguistically and culturally different from oneself (“Intercultural Communicative Competence,” 1) [8]. Whereas “effective” usually relates to one’s own view (i.e. “etic” or outsider’s view), of one’s performance in the second language/culture; “appropriate” relates to how one’s performance is perceived by one’s hosts or foreign audience (i.e. “emic” or insider’s view). The glossary exercise was also useful, therefore, in fostering greater awareness of perceptual difference from the standpoint of the target audience. At the conclusion of the project, the class worked collaboratively to fashion the *Carta de Introducción* or preface page. The instructor provided an initial draft with blanks in the text where students deliberated and negotiated in Spanish as to the more appropriate choice of verb forms, concepts, and ideas. This exercise also led to a discussion of the Andean concept of reciprocity (*ayni*: “you help me, and I help you”) and of the intercultural recognition of humility and respect. The attempt to consider the text from the addressee’s point of view also defines empathy, important to intercultural sensitivity. Learning a new language may supply translation capabilities, but the ability to understand variable meanings that are being expressed is not only a shift in language use but in interpretive and cultural comprehension capabilities.

Cognitively and linguistically the translation task affords students practice in managing their literacy skills and negotiating between reading, writing, and speaking. Because these activities occur within real world constraints, comprehension is better understood by students as a fundamental anchor for production. Students focus on language learning as collaborative praxis. Misidentifications (i.e. *morder* used to translate “to bite” when referencing mosquitoes) were clarified as a group when individual results were compared in class, where speculation on a probable translation became an exercise in cultural nuance.

As they moved from acts of synthesis and interpretation to translation (production) of the ISD reports, conceptualizing the typology of the text genre's data, students practiced and learned specific grammatical structures they had not acquired in previous classes. As they tackled technical and engineering problems, speculations, solutions, methods, goals, and recommendations or alternatives for the future, passive voice, preterit, conditional verb forms, and subjunctive (mood and forms) were increasingly performed. Without extensive command of the target language, students were able to manage grammatical content through both group work and general class discussion. The focus on meaning, defined in modern language instruction as the "systematic integration of language form with content and context" (Swaffar and Arens, 16), as processed through the task of translation in its many forms, became the benchmark for our cross-disciplinary collaboration. In this context the Spanish students saw their learning as integrated not fragmented, with language use in communicative frameworks—not mastery—as the benchmark for evaluation.

### Evaluation and Emotional Impact

The ISD translation project in its various stages constituted 45% of the course grade, with participation and attendance (30%), and other written graded assignments (25%) making up the remainder. Most written assignments, including vocabulary and culture quizzes, were integrated with the ISD translation project. Since communicative intent is part of a pattern of social literacy, and because the course also focused on teaching students how to make translation choices, team work was rewarded alongside the actual language (and final ISD translation) produced. Since students worked primarily in teams within the parameters of the corporate model of expected product quality, tasks were evaluated on overall performance, and on completion of the final draft in a timely and satisfactory manner.

The post-project survey results (**Appendix C**) conducted at the end of the semester indicated that students felt they had improved their knowledge of Spanish grammar and technical vocabulary. Not surprisingly, however, their initial enthusiasm about working in teams was tested with the translation project. MTU students are used to working on short-term team projects. It is not unusual, therefore, that the longer teaming process of the ISD translation project proved challenging and even a struggle for the students. The post-project survey results also indicate that students did not fully understand the complexities surrounding the concept of sustainability, which—as engineers acknowledge—is much broader than students first anticipate. The graph downturn comparison (**Appendix D**) may, in fact, reflect growth, proving that the course was challenging, and revealing "new learning" regarding team work and concepts of sustainability. The strongest and most positive impact of the pilot collaboration was reflected in students' assessment of the socio-cultural and intercultural aspects of the project. Students agreed that they now had a better understanding of the social and economic climate of the country, and an improved understanding of the causes for the infrastructure problems it was currently facing.

Working on “real” problems also helped the students connect emotionally to the project, to the ISD engineering teams, and to the Bolivian “clients.” “The fact that people will actually read and care about our translations is a big booster,” noted one student. This indirectly simulated intercultural experience, in other words, encouraged empathy and a perspective of shared participation in the creation of reality and meaning. As two students summarized it in their own words, “[t]his has probably been the most worthwhile class I have taken in my educational career. The most worthwhile aspect about this project is that we are making an impact on the lives of people halfway around the world.” Having grown up with one culture that provided the “answers” to the problems of life, coming to know that there are ways of doing things that work well for others, and may even work well for us, is an important realization. While it was not clear that the project experience had engendered humility along with empathy, like the process of translation itself, students were able to integrate difference while maintaining the obvious distance, “always in the process of becoming a part of and apart from a given cultural context.” As Margaret Pusch explains, this “constructive marginality” is “a complex state in which individuals have no natural cultural identity but are constant creators of their own reality, drawing on all they have learned but considering all assumptions at a meta-level that is not specific to any one culture” (*Knowing and Doing*, 158) [9]. This means that when students engage in “the practices of another culture,” they are not giving up their native culture but adding new practices and ways of thinking to their set of options for behavior and value. Fundamental to acquiring respect for difference and intercultural sensitivity is the acquisition of a sense of process, understanding that values and assumptions are not fixed “rules” as much as they are a creative process—something very akin to what is mirrored in the process of linguistic and cultural translation itself.

## Conclusions and Final Recommendations

While one student complained that it was “a ridiculous amount of work for the credit” received, the vast majority of students saw the pilot project experience as challenging and highly valuable. Our pilot research strongly suggests that students benefit from cross-disciplinary collaborations and an integrated use of language in language learning. The integration of cross-disciplinary content with language instruction, interrelated activities in which language and cross-disciplinary ideas are mutually constructed, not only “worked students’ brains,” encouraging critical thinking, reflection, and deep analysis, but also meaningful communication, the kind that works to link form, content, and context. Along with socio-cultural knowledge, students acquired skills in synthesis, team collaboration, and increased self-confidence in “reading” (translating) engineering and other technically challenging texts.

Thomas Friedman (*The Lexus and the Olive Tree*, pp. 159-161) [10], in speaking of the truly intercultural experience, talks of learning to think in six dimensions: politics; culture; how power is defined and balanced; financial markets and trade operations; technology; and the environment. The ISD Engineering and Spanish for Cross-Disciplinary Literacy collaboration helped Spanish faculty redefine our commitment to language teaching as the teaching of multiple literacies, not just language learning. This

collaboration required us to move away from traditional course planning and normative assessments and to increase learning by presenting linguistic and cultural content in an intellectually challenging manner, commensurate with our institutional disciplinary and interdisciplinary offerings, and capitalizing on our students' motivation and drive for applied ("real") studies. The pilot collaboration helped inform students that language is a culture-based performance, situated in various public, private, and cross-disciplinary contexts. Recent language research reflects an understanding of multiple literacies as socially bounded and contextual, no longer accessible solely through command of language as traditionally presented in many modern language classrooms. The forced scholarly attention on this "field of cultural production" has led to less dogmatic insistence on linguistic correctness, and linguistic equivalence—lessons revisited in the process of translation—and to greater insistence on students' abilities to engage with other cultural discourses, with their forms of knowledge and communication, and with their various publics.

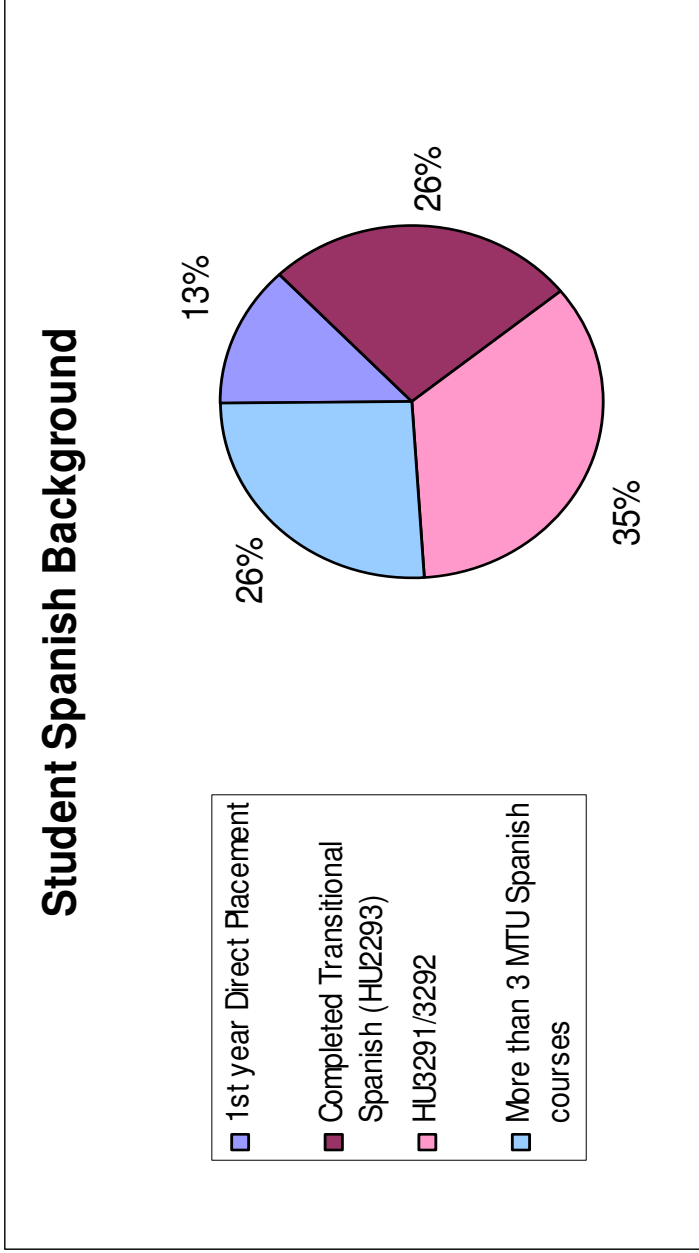
The pilot collaboration also helped participating faculty highlight the significance of cross-disciplinary collaborations across the university. Cross listing of the International Senior Design class (CE4990/CE4905) on the French and Spanish International Minor degree schedules has received departmental approval. This will allow students seeking an International French or International Spanish Minor to complete a portion of their study abroad requirements by participating in the ISD initiative in a developing region, while acquiring target-language and on-site intercultural experience.

Even more significant, the pilot collaboration encouraged thoughtful and critical reflection on the nature of international service learning, the effects of our presence in developing countries, and the ways these issues affect student learning. While it is imperative today that all students be educated for solidarity with those most marginalized in the new global order, it is equally important to engage students with the hard questions. If we as mentors position students as the "saviors," focused solely on helping materially without fomenting the desire to build long-term relationships with partner "clients," then we may have failed in our education for justice. As Robin D. Crabtree argues, however, where international service learning is integrated into actual course work, where it is done together with others, and above all, where it takes place in a context of on-going reflection about the meaning and value of the work, it can have life-changing consequences. (*Conversations*, 39) [11]. In line with our varied tasks as *multiplicadores*—participants and "specialists" engaged in socially oriented activities who in turn shed significant impact upon still others—cross-disciplinary literacy-based language acquisition pedagogy has empowered us to engage others in shared intellectual, social, and ethical projects and goals beyond the restricted parameters of the traditional language-learning environment and toward more relational, reflective, and inclusive local and global discourse communities.

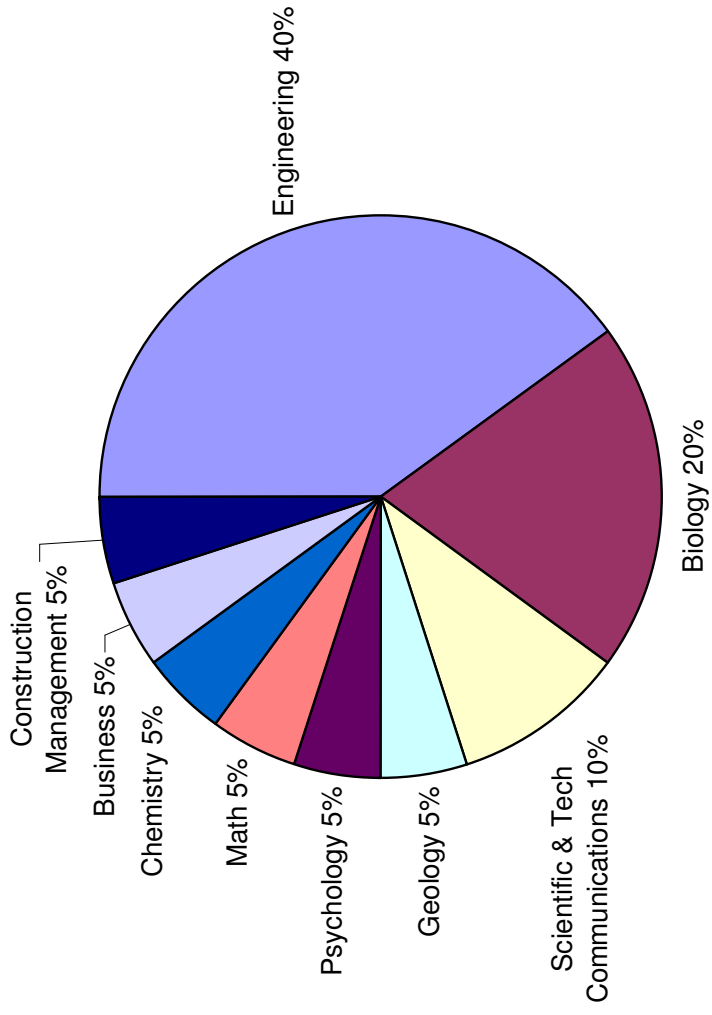
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**APPENDIX A**



**APPENDIX B**



**Enrollment by Major**

**APPENDIX C**

	<b>STATEMENT</b>	<b>PRE Responses</b>				<b>POST Responses</b>			
		<b>Mean</b>	<b>Std Dev</b>	<b>Variance</b>	<b>Std Error</b>	<b>Mean</b>	<b>Std Dev</b>	<b>Variance</b>	<b>Std Error</b>
<b>1</b>	Know Spanish Grammar	6.71	1.76	3.11	0.39	7.9	1.29	1.67	0.29
<b>2</b>	Comprehension of Technical Spanish	6.70	1.49	2.22	0.31	8.2	1.24	1.54	0.28
<b>3</b>	Experience working in Teams (peer and instructors)	8.95	1.21	1.47	0.26	7.65	1.57	2.45	0.35
<b>4</b>	Acquired Technical Vocabulary					8.1	1.45	2.09	0.32
<b>5</b>	Can Identify Technical Translation Problems and Offer Possible Solutions	7.30	1.46	2.13	0.30	7.5	1.54	2.37	0.34
<b>6</b>	Understand that I can Learn Other Subjects/Knowledge by using Spanish					7.4	1.27	1.62	0.28
<b>7</b>	Better Understand Economic and Social Climate of Bolivia					8.65	1.42	2.03	0.32
<b>8</b>	Better Understand the Concept of Sustainability	8.52	1.31	1.72	0.27	7.2	2.50	6.27	0.56
<b>9</b>	Better Understand Concept of Intercultural Communications					8.9	1.17	1.36	0.26
<b>10</b>	Better Understand "Real" Problems of Bolivian People					8.7	1.49	2.22	0.33

APPENDIX D

Average Project Survey Response

