Intensive English Program for Future Engineering Students:
An Action Research

Gloria Chen, Indiana Tech, United States

Abstract
A large portion of international students studying in the USA take pre-college or pre-graduate school intensive English courses to improve their English skills in order to fulfill the language requirement of the universities. While most intensive English programs offer courses that address skills of listening, speaking, reading, and writing, etc. for students' academic enrichment, not all the programs put the preparation for students' future major or concentration of studies in their curriculum. The college where the author teaches, an institution of technology, enrolls a great number of non-English speaking international students who are conditionally accepted to engineering programs pending the satisfactory English proficiency. With students' need of "English for Engineering Courses" in mind, the Intensive English program faculty have incorporated 'English for Future Engineering Students" in the curriculum. The curriculum includes a review of Math, terminology of technology, critical thinking, basic technical writing, research skills, proposal writing, writing for journals, and oral presentation for conferences, etc. The learning outcomes have proved this curriculum is effective and helpful for students who eventual enter and stay in the engineering programs. This paper presents the highlight of the four-semester long action research and prospective amendments.

iafor

The International Academic Forum
www.iafor.org

Introduction

English has been the world's predominating language of science, engineering, technology, and other disciplines of scholarship. As Altbach (2004) points out, English is used to communicate knowledge worldwide, to instruct (even in countries where English is not the language of higher education), and to implement cross-border degree programs. Higher education worldwide must grapple with the consequences of the dominance of English as a factor in globalization. The English Proficiency is one of the first steps taken by students who come from countries where English is not a major language. The English Proficiency Requirement (EPR) is used by colleges and graduate schools to evaluate the English language proficiency of students whose native language is not English and who want to enroll in colleges or graduate schools. Each college has different EPR; students who provide sufficient language test scores they are usually accepted as domestic students; however, in case their English test scores are not high enough, they will be required to take supplementary English courses. These courses can be affiliated to the college, or offered by independent language schools. In addition, many students take these pre-college English courses voluntarily before applying for college or graduate school programs.

Since engineering is a growing field with great career prospects both in the U.S. and overseas, and English has become the major language used in the engineering and science fields, the number of students who pursue engineering degrees in the USA has increased rapidly in the past decades. According to studies released by the Pew Research Center (www.pewresearch.org), international students make up more than half of science, technology, engineering, and mathematics (STEM) advanced degrees earned at American colleges and universities. Foreign students at U.S. colleges are more concentrated in STEM fields than U.S. college students as a whole. Among foreign students at all academic levels, business was the most popular field of study in 2013-2014 (188,179). But the next-most-popular fields were engineering (160,128) and computer and information sciences (65,291). The college where the research is teaching is a medium-size technology institution located Midwest with around 2,000 students, among which there are around 300 hundred international students studying in various engineering programs. This action research is conducted in the Intensive English Program offered to 119 in four consecutive semesters to international students who need more English in preparation for engineering core courses. Each semester offer 20 hours of language training per week, and field trips and other extra-curricular activities are either included in or added to the class hours. This course is an echo and confirmation to the claim of Riemer (2002) that "a course in English for Specific Purposes (ESP) will enhance English language training and an engineering student's communication skills. It will also aid in the globalization of education and the internationalization of practicing engineers."

Objectives of Research

This research is designed to answer the following research questions so to offer relevant curriculum to the students as well as modify and improve the existing courses:

--Who are the students and what do they think they need according to questionnaires and interviews?

--According to faculty's observation and assessment, what skills can be implemented to the program?

--What are the students' attitudes toward the program and how to make adjustment to the program to meet students' need?

--What are some extra-curricular activities the program can offer to students to enhance their learning?

Method

This research gathers data from questionnaires, interviews, assessments, and observations over the entire semester. Questionnaires and interviews were given to students and instructors as well as administrators who are involved in this program before, during, and after the program. The assessments are conducted by the instructors to all students in the beginning and at the end of the semester. The observations, which are done formally by the instructors in class or informally through students' activities, are recorded frequently.

Results of Preparation

The results of the preparation for this action research are listed along with the research questions listed in the Objectives of Research:

- From students' perspective, who are the students and what do they think they need according to questionnaires and interviews?

    --They are English learners; therefore, they need skills in all aspects of the English language: reading, writing, listening, grammar, two-way communication, American culture, special culture in the American industry, special culture in the American college, etc.
    --They are engineering students; therefore, they need study skills of college courses, especially math, science, and engineering courses.
    -- They are future engineers; therefore, they are interested in finding more up-to-date information and obtain more knowledge in the technology fields.

- From instructors and administrators' perspective, what skills can be implemented to the English for engineering student program?

Four areas are explored:

--Intercultural Competence: Most international students strongly feel they should learn the American culture; as much as the program work on teaching the students American culture such as sports, music, art, holidays, festivals, ethics, etc., students are encouraged to understand the cultures of their international peers and take ownership of their own cultures and freely share and communicate with one another on the topics of cultures. We instilled in students' understanding that each culture is valuable, and one should feel proud of his/her cultural background and be acceptant to others' cultures. Therefore, the intercultural competence is an important part of this program.

--Abstract Concept in English: According to The American Engineers' Council for Professional Development, engineering is a unique and creative way of using science and math to design and operate a variety of different structures, machines, and processes. For an engineering students, it is easier to exercise these thinking skills in his/her own native language; however, once he/she switch the "thinking language" into English, he/she feels handicapped. Therefore, students are encouraged to make think the abstract or complicated matters in English and learn to express it orally or in writing.

--Critical Thinking Skills: Many students lack independent and creative thinking skills due to their education backgrounds. Therefore, students are encouraged to "think outside the box" of the information they receive from the instructor, textbooks, the Internet, or other sources. Using "critical thinking skills" can sharpen up their productivity. Students also learn how to determine "information filters" in order to find and receive information that is correct, relevant, and not "false news."

--Other academic skills including understanding of academic integrity, format of engineering papers (IEEE concentration), cause and effect analysis and explanation, analysis for comparison and contrast, graphics, etc. The academic integrity is particular stressed since some students are not aware of the seriousness of plagiarism in the academic work. A variety of patterns of essays are introduced to students to help them develop the range of their writing and oral presentation.

• What are the students' attitudes toward the program and how to make adjustment to the program to meet students' need?

--Toward English: Most students have more receptive skills (reading and listening) than productive skills (writing and speaking), but a great number of students have problems understanding native English speakers due to speed and regional accent. They may feel frustrated when they are not able to understand their instructors or interlocuters, and when their ideas are not understood or are not able to make smooth communication with their

instructors or other interlocutors. Being future engineering students, they expect themselves to be "smart" and "efficient," so they may feel anxious about their progress in English, as their major goal in coming to the USA are obtaining an engineering degree, not becoming an English scholar; sometimes they feel the training of the intensive English is a "waste of time and money," though in reality they cannot skip or expedite the process of learning and getting used to the new language and the environments. The instructors may encourage them to be patient to themselves and keep a learning log or journal to record and track their own progress.

--Toward Academic Readiness for College: The Intensive English Program incorporates the review of math and science, logical/critical thinking, trouble shooting, team work in project based learning, conducting discussions or group meetings, etc., so students establish for themselves a community of "engineering," getting ready to enter the engineering program in the following semesters. For effective communication, we emphasized on the following skills in both speaking and writing: definition and explanation of scientific/technological terms, description of special order, description and explanation of process of completing a task, examining a work and pointing out its characteristics, etc.

- What extracurricular activities can we offer to these students?

  --Visiting industries/factories and observing work/projects in the field. In order for students to understand what a real engineering environment is like, it is helpful to visit work sites. Contacting local industries and companies and making requests for visiting will benefit the students.

  --Interview skills: The interviewing skills can include, but are not limited to, job interview skills. Students are also encouraged, sometimes required, to interview fellow students or senior engineering students, and anyone they meet who are interested to be interviewed. Students design interview questions and report in class the process and contents of their interviews.

  --Listening to guest speakers and other speeches. The Intensive English Program may invite guest speakers to class to share their learning and working experiences in various settings. Since the Intensive English program is a college-based program, students are eligible to participate in all the college activities, including all the sports, concerts, academic forums and conferences. Students should be encouraged to attend as many of these events as possible, either directly related to their studies or not, and learn to associate with fellow participants to build up social skills and practicing communication skills outside of classrooms.

  --Internship opportunities and OPT training: Since some of the students will consider working in the USA to gain some real-world experiences, they will have to be familiar with the policy and regulation about OPT (Optional

Practical Training). International students in the U.S. in valid F-1 immigration status are permitted to work off-campus in optional practical training (OPT) status both during and after completion of their degree. Rules established by the U.S. Citizenship and Immigration Service (USCIS) govern the implementation of OPT, and all OPT employment requires prior authorization from USCIS and from your school's International Student Office. These policies should be incorporated in the extracurricular sessions so students can prepare for the application and comply with the regulations.

Action Research Launched Taken

After collecting the necessary information form the participants, including students, instructors, and administers, a class named "College Skills" is created to meet the specific goal and need.

1. Rationale:

The goal of the course College Skills in the Intensive English Program is for international students who are currently taking English courses at the Intensive English Program to prepare to take the courses elated to their future majors in the Engineering program. Students are expected to obtain the basic information, knowledge, and skills outlined in this course, in addition to the conventional courses of reading and vocabulary, writing and grammar, and listening and speaking that are design for all IEP students regardless of their future majors in college or the graduate school. The focus of this course id on developing the proficiency of English in Engineering Courses.

2. Procedure:

Step One: Design the Course with a Syllabus

The following is a partial syllabus reflecting the objective and the exercise of this course:

Course Description

This course provides extra practice in a variety of language and technology skills to students who are planning to enroll in engineering courses after successfully completing the Intensive English course. Students will employ college resources to navigate the academic environment, and obtain competence with information technology so they will be ready for the challenges of the Engineering courses and beyond. Topics range from systems in the engineering field, explanation of terminology, descriptions and analysis, writing of user's manuals, etc. Field trips to local industries/companies and presentations of guest speakers in the engineering professions will be arranged to help students reach out to the real-world environment, so they will obtain a profound understanding of their future endeavor.

Course Learning Objectives

Upon successful completion of this course, the student will be able to

- Understand the social, cultural, and industrial system in the US
- Apply skills in taking lecture and textbook notes and figure out main ideas, key points, dates, and important information
- Apply skills in summarizing, paraphrasing, analyzing, and memorizing in preparation fir technical writing and communication
- Apply strategies in data collection and preparation for oral presentations on subjects relevant to the pursuit of an engineering degree

Course Learning Outcomes

- Knowledge: Students will understand the range of information necessary for studies in the engineering programs
- Skills: Students will be able to use critical reading and thinking skills to analyze and understand the contents of textbooks in science, math, and engineering, etc.
- Attitudes: Students will be willing to constantly enhance their study skills.

All-Skill Projects

This College Skills course incorporates an all-skill Independent Studies Research Project into the curriculum. With the consultation of instructors, each student will complete four independent studies projects a semester. For each project, the student chooses a topic related to his/her future major in the engineering program, and uses all sources available to discover the answers/solutions to his/her quest. The project is completed with a multimedia portfolio, with texts, graphics, videos, etc., and will be presented orally to the class four times a semester. The portfolios and the presentation will be graded as a major part of the grades. The instructor makes frequent appointments with the student to discuss his/her progress, to find his/her strength and weakness, and to seek ways for improvement and enrichment. Instructors of the engineering programs will be invited to offer support and consultation.

Step Two: Creating Appropriate Text

This is a big challenge to the instructors, since the future majors of the students diverse from industrial engineering to civil engineering, from mechanical engineering to biomedical engineering, although all are in the engineering framework. We are not able to use a "one-size-fits-all" textbook to meet the individual needs of students. After carefully evaluating the students' needs and their language proficiency, we decide not to adopt a certain textbook in this experimental stage until more textbook options are available; instead, we explore the Internet and find up-to-date information about technology for students to read and analyze. Students are also encouraged to find materials interesting to them

and share them with the instructors. If the instructor see fit, the materials can be utilized or modified for class use. Once in a while, the instructor will borrow textbooks from the campus book store and assign a certain portion for students to read, The text selected can provide ample avenues for exploration and discussion. When the text is used, it is preferred not to be too long or too complicated so the language-learning students can concentrate using the information rather than struggling in finding the meaning.

Step Three: Students Setting Out to Work

The followings are some of the work/projects the students complete:

- Oil Drilling: Many students are pursuing a degree in energy engineering. The reading "Coastal Drilling in Sunny California" by Edward I. Maxwell retrieved from ReadWorks.org provided students with introduction to "slant drilling" as an environmentally safe method of drilling of oil. After reading this piece, students do some more research on different ways of drilling and their pros and cons, and make comparison and contrast on these methods. They also conducted a debate on the clash between energy development and environmental concerns.

- Climate Change: This unit is a part of the Book 3 of students' Intensive English textbook "NorthStar Reading and Writing." Students explore the geopolitical aspect of climate change to make a connection between technology, science and humanities. Students use cause and effect patterns to make connection between climate change and human behaviors, and also debate over the reality and accuracy of these connections. Students then write essays to compare and contrast different theories on climate changes.

- Animal Intelligence: This unit is a part of the Book 4 of students' Intensive English textbook "NorthStar Reading and Writing." This unit focuses on the intelligence of animals and how to evaluate that intelligence. Considering some students are interested in the biomedical engineering field, we use this reading to inspire students to pay more attention to animals. During the study period, students observe and question whether animals are more intelligent than expected. They are also encouraged to observe children's intelligence and write a descriptive essay.

- Powerful Weather Satellite: The reading "Seriously Powerful Weather Satellite Put into Space" retrieved from breakingnewsenglish.com provided students with up-to-date technology information. Students who plan to major in mechanical engineering are highly motivated in finding out the satellite. To make this study more relevant, the students are told actually a major part of this satellite is designed and manufactured in an aerospace company located in the same city where the institution are.

Students are excited to interview and listen to one of the engineers evolved in this project.

- Field trips to local industries/companies: The Intensive English Program, with the help of the campus career center, contact several local industries and companies, including a metal manufacturing company, an electricity company, an automobile manufacturer, and a mechanical company, and take the students to tour the facility, to speak with the employees, and to observe the working procedure and find current practices in a particular field. Some of these companies generously offer "mock job interviews" opportunities to the students and coach them with interview skills and explain to them the HR requirements and policies. In addition, students take trips to museums of automobiles and science museums and have hand-on opportunity to find out how these products are manufactured.

- The capstone project: "My college Major and Its Prospect." Students are divided into small groups of four according to their future majors, such as industrial engineering, mechanical engineering, energy engineering, electrical engineering, and biomedical engineering, and research on the courses they will have to take and complete, along with general education courses and elective courses. They will list the course titles and the course descriptions listed on the university catalogue, collect syllabi from their future professors, and find the learning outcomes of each course. Meanwhile they are encouraged to interview professors and current engineering students of their future majors to fine more information. Also, they will find the possible job choices of their fields, opportunities for advance, and even possible salary and benefits. After a few weeks' research, each small group will compile their findings onto posters or PowerPoint files and give presentations to the entire large group. Students perform peer critique and give explicit and specific comments.

- Summer Internship: Students are encouraged to find internship opportunities locally or out-of-town in the summer to gain real-world experience. These opportunities might not be ample, and due to the visa status, the students who have the internship opportunity may not be paid, but they value the experience more than the monetary reward, and by working with in an English-speaking environment, these interns are able to rapidly improve their English communication skills.

Step Four: Assessment of Students Progress

The assessment is designed to reflect the students' learning outcomes listed on the syllabus. Four tools are used in the assessment: Tool 1 is In-class tests, which tests students' understanding of certain terminology and some basic concepts of science and engineering. For this course, we try not to give students too much pressure in "studying for tests,' so this is the only "summative assessment" we exercise. The other three are formative assessments that are given periodically over the entire

semester: Portfolio, Students' Reflection, and Instructor's Observation. (On a scale of 1-5: 1-beginning; 2-developing; 3-productive; 4-satisfactory; 5-excellent)

Outcomes/Goals	Assessment Tool 1: In-Class Tests	Assessment Tool 2: Portfolio	Assessment Tool 3: Students' Reflection	Assessment Tool 4: Instructor's Observation
understanding the range of information necessary for studies in the engineering programs				
being able to use critical reading and thinking skills to analyze and understand textbooks in science, math, and engineering, etc.				
being willing to constantly enhance their study skills				

According to the assessment results, more than 75% students are able to receive 3 and higher on a scale of 1 to 5 in each category.

Step Five: Improvement Actions

During the semester, the instructors hold meetings and specifically examine each course goal and check the progress of students. In case any student does not reach 3 and higher on a scale of 1 to 5, the following actions are taken:

1. Discussing with students individually and analyze the student's learning style and improvement strategies.
2. Connecting with students in different college majors, classes, and organizations, as well as with senior engineering students, and professors, in order to broaden their resources, so students are better motivated.
3. Practicing using English to ask specific questions about the learning material, and pay close attention to the explanation of the instructor or classmates.

Conclusion and Suggestion for Modification

As Coppola (2011) points out concerning technical communication, "our core competencies are not defined by the end products we produce but by our demonstrable knowledge and skills, and we recognize that technical communication is as much about craft knowledge as codified knowledge, often tacit as well as explicit." English for future Engineering students is a course to enhance students' knowledge and skills in both tacit and explicit ways, both challenging and rewarding. At the end of this course, students are equipped with good communication skills and other soft skills and ready for their college courses. The evaluation of the course is constantly conducted in order to modify the course based on the students' performance and their future needs. The students who have completed this course and entered the engineering programs can be invited back to the Intensive English classes to share their experiences and work with the instructors to discuss the strength and weakness of the course and suggest activities to make the course more effective. Several related textbooks written by experienced instructors have been published in the recent years, and the program can begin to evaluate these resources and consider adopting appropriate textbooks for sequence learning.

References

Altbach, P.G. Tertiary Education and Management (2004) 10: 3. doi:10.1023/B:TEAM.0000012239.55136.4b

Coppola, N. (2011). Professionalization of Technical Communication: Zeitgeist for Our Age Introduction to This Special Issue (Part 1). *Technical Communication, 58*(4), 277-284. Retrieved from http://www.jstor.org/stable/43092883

Pew Research. http://www.pewresearch.org/fact-tank/2015/06/18/

Riemer, M.J., English and communication skills for the global engineer. Global J. of Engng. Educ., 6, 1, 91-100 (2002).