2006-1021: PREPARING ENGINEERS FOR THE GLOBAL WORKPLACE: THE UNIVERSITY OF CINCINNATI

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Preparing Engineers for the Global Workplace: The University of Cincinnati International Co-op Model

Abstract

In 1906, the University of Cincinnati developed the concept of Cooperative Education in the College of Engineering. Today UC has the largest cooperative education program at any public university in the Country, with 4,000 students (from five colleges) and 1,500 employers.

The College of Engineering continues to be a leader in the field, creating the International Engineering Co-op Program in the early 1990s. Now after expanding to include students from all UC’s co-op colleges, the ICP is one of the University of Cincinnati’s premier programs.

The International Co-op Program responded to the need to improve the ability of American students, particularly engineers, to understand and deal with other cultures. Initially programs were created in German and Japanese. A Spanish program was added later. The goals of the programs were two-fold: to improve students’ knowledge of a specific language and culture; and to familiarize them with the social, economic, and industrial structures of their chosen country. Following a rigorous preparation program in the US, students use their technical, language, and cross-cultural skills in a capstone co-op assignment abroad. The combination of skills acquired through the professional practice and language/culture programs creates a structure which attracts highly-motivated students, and allows them to succeed in an international work environment.

About ten percent of all engineering students (over 200 to date) participate in the ICP. The strengths to the UC program are: 1) Students complete four co-op quarters in the US, prior to an international co-op assignment and 2) An intensive language program comprised of over 300 classroom hours of German, Japanese or Spanish was created specifically for students preparing to live and work abroad. This combination of work experience and language proficiency has proven valuable to students and employers. The students enter an international work environment feeling confident of their technical abilities. They become employee who can work independently and take responsibility for their own projects. The language proficiency and cultural understanding enables them to quickly assimilate themselves into a new culture, and become productive members of work teams.

The most recent addition to the program is the creation of two learning modules, which students are expected to complete during their international assignments. The learning modules are designed to make students aware of how their newly-acquired language skills enabled them to better deal with problems and to better understand the culture in which they’re working.

Over the next few years, the University of Cincinnati plans to expand their international co-op program by implementing new initiatives, to create more opportunities for students to co-op abroad and to attract international students to the University of Cincinnati to meet the needs of employers for a culturally diverse workforce with the ability to work across borders.
Introduction

The Division of Professional Practice at the University of Cincinnati (UC) is the centralized unit for the administration of all programs of co-operative education. There are eighteen full-time, tenure-track faculty members and seven part-time adjunct faculty members in the Division, who work with approximately 4,000 co-op students annually. These faculty members are responsible for programs of co-operative education in five colleges: Arts and Sciences; Applied Sciences; Business; Design, Art, Architecture (DAAP), and Planning; and Engineering. The Engineering and DAAP co-op programs are mandatory for all students. The structure of the UC Co-op Program is shown below. Numbered blocks are co-op-quarters. Remaining blocks are academic quarters. It is based upon full-time, alternating quarters of study and co-op beginning in the sophomore year, extending over three years. This format makes the achievement of a Bachelor’s degree a five-year endeavor. Participation in the co-op program is mandatory for 80% of UC co-op students and most students complete six quarters of co-op, although some may have less depending upon when they are eligible to begin the co-op rotations. While the students do not receive academic credit for participation in co-op, their participation is noted on their transcript as Professional Practice Credit, and completion of a minimum of four quarters of co-op experience is required for graduation in mandatory programs.

The International Co-op Program (ICP) is an extension of the co-op model, and responded to the need to improve the ability of American students, particularly engineers, to understand and deal with other cultures. The goals of the programs were two-fold: to improve students’ knowledge of a second language and culture and to familiarize them with the social, economic, and industrial structures of the country in which they will co-op.

Funding to create the ICP was provided by a three-year FIPSE grant, through the Department of Education, with the University providing matching funds. When the grant expired, permanent general funds were allocated to continue the program. Seven years after the program was
developed in the College of Engineering, it expanded to include students from the other co-op colleges.

Participating students must maintain a 3.0 GPA and be in good standing in the co-op program. The program criteria ensure that students who undertake the language training are succeeding in their existing academic program. Following a rigorous preparation program in the US, students use their technical, language, and cross-cultural skills in capstone co-op assignments abroad. The combination of skills acquired through the professional practice and language/culture programs creates a structure which attracts highly-motivated students, and allows them to succeed in an international work environment.

Some schools develop criteria to determine which students are likely to succeed in an overseas assignment. However, we believe that our program is self-selecting. The extensive preparation and commitment required to complete the language/culture program ensures that students who become eligible for the capstone international placement have realistic expectations about living and working abroad and are highly motivated to succeed.

Curricular Structure

Since the UC Baccalaureate (Co-op) Program already spans a five-year period, the ICP is designed to fit into the students existing curriculum without adding time to graduation. Requirements include a course titled “Orientation to International Co-op”, choices of international electives, and over 300 hours of specially designed language/culture courses.

Through the language/culture program, students receive intensive and traditional training in a short period of time (about eight months). Placing them into the new environment immediately afterward strengthens newly-developed language skills; and students in the German and Spanish programs can become almost fluent after a six-month work assignment abroad. The intensive language/culture program was developed specifically for the ICP because the rigid structure of the co-op programs and the curriculum of the professional schools cannot accommodate a sufficient number of traditional language classes for students to develop adequate communicative skills. Students, of course, develop skills in reading, writing and grammar, but the primary focus of the ICP language program is on development of oral communication skills.

The first language class, which replaces six weeks of the fourth co-op summer quarter, is an intensive course. The Japanese class is taught in a combination of Japanese and English. German and Spanish classes are taught entirely in the target language. During this period, classes meet five days a week, six hours each day. Students are expected to spend an additional three to four hours outside class to review and prepare for the following day. Over the next two quarters (fall and winter), students participate in three credit-hour language/culture courses designed to improve language skills as well as expose them to recent history, current events, and political systems. The courses also focus on understanding non-American work environments, and include professional and technical vocabulary. A second two-week intensive program is held overseas in the spring, just before students begin international co-op assignments. This program, which is a combination of classroom work and outside activities, is designed to integrate students into the community. They use their language skills continually with native
speakers, and gain confidence in a protected environment before going out on their own into a work environment.

The University of Cincinnati places strong emphasis on the ICP language program. Historically, we’ve found that students who can communicate well are usually given higher levels of responsibilities at work – a direct goal of the overall co-op program. Sending students with strong language skills also creates consistency; and employers can develop expectations about the level of language proficiency a UC international co-op student will have.

Minor adjustments to the co-op program structure, shown below, are made to accommodate the International Co-op Program and provide a six-month period for the international co-op assignment. Numbered blocks are co-op quarters. Remaining blocks are academic quarters.

Creation of the Co-op Curriculum

As tenured faculty whose academic specialty is co-operative education, we have long been engaged in activities to define, document and assess learning that results from the co-operative education model. The tensions between educating for a discipline and preparing students for the workplace are ongoing. At UC that tension is evident in the fact that the overwhelming majority of co-operative education students are in professional programs (Architecture, Business, Design, and Engineering). But as accrediting bodies (regional as well as specialized and professional) begin to require more evidence of student learning in competencies beyond individual disciplines (e.g., critical thinking, civic engagement, teamwork), the important role of co-operative education and other work-based learning models is becoming more apparent. Documenting and
assessing the learning outcomes of such models remains a challenge. As Palomba and Banta have noted, “Whether or not educators have been successful in helping students prepare for the workplace remains a subject of much debate.”

Bearing this difficulty in mind, the UC Division of Professional Practice moved to create a co-op curriculum designed to focus student attention on specific areas of learning; to create a universally utilized set of instruments that include a defined student project to be completed while on the co-operative assignment; and to include multiple assessments that capture perspectives from the student, the employer and the faculty member. This approach is designed to allow faculty to better document and assess learning outcomes.

The challenge faced by Professional Practice faculty in the curriculum development process is described by Alexander Astin when he discusses the difference between conceptual outcomes and outcome measures: “Because they reflect the desired aims and objectives of the educational program, outcome measures are inevitably value based. The very act of choosing to assess certain outcomes rather than others clearly requires us to make value judgments. In this connection, it is important to distinguish between the value statement – a verbal description of some future condition or state of affairs that is considered desirable or important (e.g., competence in critical thinking) – and the actual measure selected to represent that outcome. The former might be referred to as the conceptual outcome; the latter as the outcome measure. The task in developing an appropriate outcome measure is thus to operationalize the conceptual outcome in some way (e.g., to develop a test of competence in critical thinking).”

Professional Practice faculty recognized that students achieve a host of significant learning outcomes through co-operative education work experiences, many of which are described by Cates and Jones. “From the standpoint of academic faculty there are several outcomes of co-operative education that are critical. As an educational strategy, co-operative education provides learning that is related to the students’ curriculum. From the standpoint of industry, it is important that students have the technical knowledge that their academic preparation provides, but it is equally important for them to develop workplace knowledge.” It became increasingly apparent to the Division that the focus of the co-op program should be upon those areas that are critical from the standpoint of both academia and industry.

The faculty also recognized that, unlike a laboratory that is under the control of the faculty member, our students’ learning environment is under the control of the co-op employer. While the goal was to develop a curriculum that provided all students with common learning outcomes that they would be developing through participation in the Professional Practice Program, faculty members were well aware of the time constraints students would face. The curriculum must enhance the learning that is taking place naturally on the job and should not conflict with, or take priority over, students’ job responsibilities. The challenge was to focus on the targeted learning goal and develop a methodology that would achieve this goal without an excessive time commitment on the part of students while they were on the co-op work assignment and, more importantly, without compromising the confidentiality of the co-op employer.

The Division of Professional Practice elected to create a co-op curriculum based on learning modules to be completed during each of the students’ co-op work terms. Rather than having
students complete a lengthy project, they were asked to focus on a single issue or topic throughout the quarter. The role of employers in both the student’s learning and in the assessment of that learning was enhanced by having all co-op students and their employers sit down with each other at the beginning of the work term and mutually set expectations. We saw that the initial discussion of a focused student project could facilitate that meeting, involve employers early on in a conversation about the focus area, and provide employers with a more solid foundation upon which to assess the student’s learning. The need to document that student learning had actually taken place during the co-op work term was addressed by having a modified pre-test/post-test question in both the student and employer assessment instrument.

Assessment and Instructional Goals

Student and employer assessment is nothing new to cooperative education programs. Historically cooperative education programs have been more effective at gathering programmatic assessment data than other academic units due to our external focus on employer feedback. Cooperative education has traditionally relied upon using multiple data collection methods from multiple perspectives as well as using student-constructed methods of evaluation throughout all phases of student development. However, most assessment tools focused on student and employer performance.

To ensure that the cooperative education program at the University of Cincinnati contributed more significantly to the undergraduate education of its students, the Division of Professional Practice developed instructional goals. These goals include:

• Instruct and direct students in integrating theory learned in the classroom and laboratory into professional practice assignments and use practice experiences in the classroom to further develop professionally.

• Increase students' technical knowledge and skills through discipline-related employment; strengthen students' awareness, knowledge and development of the professional and interpersonal skills and behavior needed to be effective in the workplace; and increase students' understanding of organizational behavior and structures.

The first four learning modules, completed by all co-op students during the first four co-op quarters, focused on the areas of Organizational Culture, Technology, Professional Ethics, and Theory and Practice. A variety of learning modules were created for the final two co-op quarters, to be selected and utilized by each individual faculty member. The students in the International Co-op Program provided a unique opportunity to assess the quality of the language and culture program created to prepare them to work abroad, as well as their ability to utilize their skills to develop cross cultural competencies during their six-month co-op assignments.

The learning modules for International Co-op Program have been used for only one class, the graduating class of 2006. This is also the first class to use any modules, and they began with the Organizational Culture module sophomore year. Statistical results of the responses are included in this paper, as well as a few representative comments from students. Eventually we would like to undertake a more in-depth assessment of the level of student cultural competence following an
international co-op assignment. Comparisons might also eventually be made between students who learn a second language and/or co-op abroad and those who do not.

The first module, Language and Society, is designed to be completed after three months in an international work environment. Students are asked to describe how second language skills enabled them to effectively communicate and deal with problem-solving situations that arose in their daily activities.

The second module, Cross Cultural Competency, is designed to be completed toward the end of a six-month assignment. Students are asked to provide a more in-depth analysis of their understanding of cultural differences in the society in which they are living, and the impact of societal differences on their work environment. We believe that students who develop the ability to succeed in one culture can effectively utilize the skills developed to adapt to and succeed in many cultures. Programs like international co-op, therefore, create a population of young graduates who will be extremely valuable to employers in the global environment.

In the first ICP Learning Module, “Language and Society”, instructions for the student project are as follows:

1) **Identify**: Identify examples of day-to-day activities in which you utilized second language skills. Describe how your language skills enabled you to deal more effectively with situations.

2) **Describe**: Describe fundamental cultural differences between the US and the country in which you live. How do cultural differences relate to verbal and non-verbal communication styles in the society in which you live?

3) **Analyze**: Considering the international environment in which you live, analyze the impact of your second language skills and cross-cultural understanding:
   a. On your ability to adapt to and feel comfortable in the environment
   b. On your ability to effectively deal with and solve problems.

Students were then asked to:

1) **Assess** your level of second language proficiency and cultural understanding at the beginning of the quarter.

2) **Assess** your present level (three months into their co-op assignment) of understanding.

Selection options were: Fair, Satisfactory, Good, and Excellent.

In the second ICP Learning Module, Cross Cultural Competency, instructions for the student project are as follows:

1) **Identify**: Identify characteristics of the social, economic and cultural systems in the country in which you live. What are the issues that govern each of these systems?
2) Describe: Cite examples of day-to-day activities from your co-op workplace that illustrate the impact of social, economic, and cultural systems on business and industry. Do you believe the examples you identified are representative of “norms” in the work culture where your international co-op assignment took place? Why or why not?

3) Analyze: Based on your understanding of the systems you identified in questions one and two, explain how the culture you have observed impacts positively or negatively on the productivity and values of your co-op employer.

At the end of each Learning Module students are asked questions in an attempt to quantify what they believe to be the primary source of their learning and to determine whether they could use the knowledge gained through the project in other environments. Students are asked to respond to the following:

I believe that my current level of understanding can be primarily attributed to my experience as explained below:

___% co-op assignment
___% classroom instruction
___% other
100%

As a result of this project, do you believe you can apply your understanding to another work environment?

___ Yes
___ No

Students were then directed to:
1) Assess your level of cross cultural competency at the beginning of the quarter.
2) Assess your present level (toward the end of their six month assignment) of understanding.
Selection options were: Fair, Satisfactory, Good, and Excellent.

Learning Module Results:

Language and Society Module:

Samples of the short-answer comments for the Language and Society learning module are:

“My second language skills helped me immensely to adapt and feel comfortable in Mexico. It was very difficult the first few days as I adjusted . . . because I lacked the vocabulary to understand everything that was going on and to say what I wanted to say. After the first few weeks, as my language skills quickly developed, I enjoyed listening to and participating in conversations . . . Without these language skills, I would not have been able to adapt and feel comfortable in these social situations.”
“I feel that most of my language skills are a mix, but the majority of my cultural understanding comes from talking with my co-workers.”

“I use German language everyday in the work environment. Activities include brainstorming for new project ideas, taking messages for colleagues, and translating various sales documents. I made a PowerPoint presentation of my suggestions for a new Intranet design and employee magazine layout. By using pictures, examples, and a format, I was able to explain my thoughts in German more effectively.”

“I used my language skills every day at work. My bosses were the only ones who spoke English. My fellow co-workers could not speak English, or maybe only a few words. Many of them came from other countries, Poland, Italy and Spain. German was our common language, so without it, I would not have been able to communicate with them.”

“Throughout the course of my two six-month co-ops in Japan, I seized as many opportunities as possible to speak Japanese with both my co-workers and perfect strangers. I knew that, in order to have any chance at mastering a second language, I would need to speak the language as frequently as possible. I quickly found that using casual questions as conversation starters was a good way to exercise my Japanese with strangers. It really challenged me, but I was happy to have that opportunity to improve my ability. During my stay in Japan, I learned that many Japanese are shy to speak English. However, once I spoke to them in their native language, it was as if a barrier had been broken down, and communication was opened between us.”

“The most obvious cultural difference between Japan and the USA is that people in Japan are much less direct. Japanese has a word for ‘no’, but it is almost never used. If a Japanese person is asked, “Will you do this thing for me?”, and they respond, “I will try”, it probably means no. In traditional Japanese culture, a truly refined person will be able to recognize the true desire of another person, without being told directly.”

“My ability to speak a second language allowed me to feel like a part of their culture. I found that the people were more open and willing to talk to me because I spoke their language. I was also able to understand conversations of people who rode the train with me to work everyday. By hearing these small conversations, I was able to understand more about their culture.”

“At work I was always solving problems. My job was to develop new chemicals for the rubber industry. I had to figure out the best mixture of a solution and the best drying methods to get them done. Afterwards, I had to confirm my results with the analytical chemistry lab. All this I had to do in German because my co-workers could not speak English. Without my German language skills, I would not have been able to complete my projects and develop new chemicals. By speaking with my co-workers in German and observing the cultural differences, I gained their respect. They were more than willing to help me when they could.”

“I do not think I would have been able to adapt half as well to living in Japan if I did not know Japanese. Certainly speaking Japanese helped me in my everyday life, since I was able to communicate with the Japanese people when I bought my cell phone, purchased tickets for the bullet train, or just needed to know what something was on a menu. Cross-cultural
understanding played a major role in my success as well. I quickly became accepted for just what I was – an international student interested in learning about another culture.”

Responses to the quantitative questions for the Language and Society module were:

I believe that my current level of understanding can be primarily attributed to my experience as explained below:

- 58% co-op assignment
- 26% classroom instruction
- 16% other
- 100%

In response to the questions:
1) Assess your level of second language proficiency and cultural understanding at the beginning of the quarter.
2) Assess your present level (three months into their co-op assignment) of understanding.

- 64% reported an increase of one or two levels.
- 37% reported no change.

Responses to the question, in both the Language and Society project and the Cross Cultural Competency project were the same. The question read: “As a result of this project, do you believe you can apply your understanding to another work environment?” The result was:

- 85% Yes
- 13% No

However, all students who responded “No” also commented that the project did not affect their ability to apply their understanding to another environment; but the experience of living and working in a foreign country did. Taking these comments into consideration, the result was that 100 percent of the students who responded indicated that they believe they would be able to apply the understanding gained through their international work experience to another work environment.

Cross Cultural Competencies Module:

Samples of the short-answer comments for the Cross Cultural Competencies learning module are:

“I wrote in my paper that “When you are in Europe for six days, everything seems so different, but when you are over here for six months, everything seems the same.” I found that major cultural differences were small things.”

“The primary source of understanding between cultures most obviously comes from actual experience in a student’s respective working field. There is no better way to learn about a culture or any other subject than by actually doing or experiencing it.”
“A cross cultural understanding can be very difficult to obtain, especially if one has not experienced culture first hand. After gaining such an experience, I believe it is then very easy to understand yet another different culture or even the differences that are present in the student’s native culture which were not previously apparent. . . . the student is then able to more quickly identify and cope with similar differences in another culture, even if there is no prior knowledge of it.”

“Japanese tend to be less direct than Americans, so business decisions are often implied or refusals are left vague, and it is up to the listener to interpret the truth. Because Japanese people tend to think that saying something is permanent, they often think over an issue for a long time before reaching a decision. This can sometimes cause difficulties when Japanese and Americans have meetings together. Very often Americans begin suggesting new ideas, while the Japanese are quiet. If the Americans are not sensitive to the cultural differences, they could assume that the Japanese people have no opinion, while in truth; they prefer to consider the issue longer before making a suggestion.”

“The amazing work ethic of Japanese people helps to explain why they are such a surprising economic force in the world, given their relatively small size.”

Responses to the quantitative questions for the Cross Cultural Competencies module were:

I believe that my current level of understanding can be primarily attributed to my experience as explained below:

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<thead>
<tr>
<th>Percentage</th>
<th>Description</th>
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<tbody>
<tr>
<td>64%</td>
<td>co-op assignment</td>
</tr>
<tr>
<td>18%</td>
<td>classroom instruction</td>
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<tr>
<td>18%</td>
<td>other</td>
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<td>100%</td>
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</tbody>
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In response to the questions:

1) Assess your level of second language proficiency and cultural understanding at the beginning of the quarter.

2) Assess your present level (after five to six months overseas) of understanding.

67% reported an increase of one or two levels.
33% reported no change.

Conclusions

The International Co-op Program was created to give students the opportunity to begin developing second language and cross cultural skills in a protected environment which could be put into practice in an overseas assignment. The ICP learning modules were developed to help encourage and guide student reflection and learning, and to provide a means to assess the attainment of specified learning objectives.
The learning modules for the International Co-op Program were used for the first time last year. Additional data will be available when the second group of students participating in the process return from international co-op assignments in the fall. The most significant data to be gathered in these modules showed that 100 percent of the students participating in the program said they believe, as a result of living and working abroad through the International Co-op Program, that they will be able to apply the understanding gained to another work environment in the future.

The pervasive theme of the responses from students was that second language skills were not only desirable, but in most cases necessary for them to successfully live and work in a foreign country. Even students who worked in jobs with co-workers who spoke English found that their ability to speak the language earned them respect and made the adaptation process much easily. The language also paved the way for a more successful experience living and working in a foreign culture. They developed a better understanding of the culture because they were able to better assimilate their new environment.

Initial data proves documentation of the learning that occurs as a result of ICP participation. The UC ICP has traditionally been small, with only about ten percent of engineers and lower numbers of students from other colleges participating. The data supports what international educators have known for many years -- that the personal and professional growth that takes place when students work abroad would be difficult to duplicate in any domestic environment. The goal of the University of Cincinnati, therefore, is to increase the numbers of students participating in international co-op across colleges. To what extent that can be accomplished will be affected by many factors, including our ability to create interest among students, resources allocated to the program, and the interest level and economies of participating companies in foreign countries.

References


5Student quotes were provided by the following students, via their International Co-op Program learning modules: Adam Follrod, Jillian Fox, Justin Gaylor, Carrie Hathaway, James Kostura, and Bethany Subel.