

A Web-Based System to Document Learning Outcomes in a Mandatory Cooperative Education Program

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Abstract - For 97 years, paper evaluations have been an essential tool for University of Cincinnati co-op faculty to track and evaluate a student's learning progression resulting from co-op experience. However, large-scale studies involving large numbers of students and employers were prohibitively labor intensive. This year an on-line evaluation system has been created so that large-scale studies of the effects and benefits of cooperative education can more easily be monitored and reported. This system will provide digital records of student and employer assessment data as well as the capability to analyze this data on a much larger scale to better document the pedagogic benefits of co-op for students. In addition, this system will allow for improved feedback to degree granting colleges and the ability to generate new surveys easily and quickly for evaluation of new experiential learning methods or developing market trends. This paper will address the development, function and potential impact of this online evaluation system.

Index Terms – cooperative education, on-line evaluation, experiential learning

COOPERATIVE EDUCATION AT UC

Co-op has historic roots at the University of Cincinnati. The concept was developed and first implemented at UC by Dean Herman Schneider in 1906 and was so successful that by 1919 co-op became mandatory for all undergraduate engineering degree programs. At that time, the Division of Professional Practice was formed to manage all aspects of the co-op program. Today the Division of Professional Practice offers cooperative education programs for students enrolled in 30 majors distributed over five colleges. Cooperative education for Engineering Technology Programs is offered by the Professional Practice Department of the College of Applied Science. The centralized organizational model, enhanced by the Division of Professional Practice's status as an academic unit, has allowed the university to develop a globally significant cooperative education expertise.

At UC, the College of Engineering and the College of Applied Science enroll a total of 3,100 undergraduate students. All full-time day students in these colleges are enrolled in mandatory co-op programs, which constitute a significant differentiator of these UC programs in the market place. In the academic year 2002-03, UC students co-oped for 1,400 employers in 34 states and 9 foreign countries. [1]

Structure of the Co-op program

UC's academic year consists of four quarters (autumn, winter, spring and summer). The Cincinnati co-op model is based on alternating sections of full-time school and work, by quarter, as illustrated in Figure I. The students enrolled in each major are divided into two sections. As one section is in school the other is on a work assignment, or co-op, and vice versa. Each student completes six quarters of co-op over three of their undergraduate years. This alternating schedule requires the university to offer all sophomore, pre-junior and junior courses twice during each academic year.

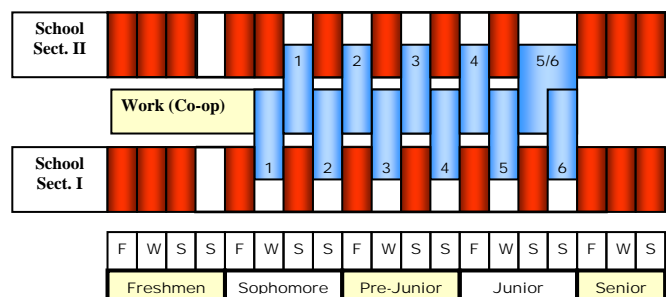


FIGURE 1
THE CINCINNATI CO-OP MODEL.

Co-op students are assigned to a Professional Practice Faculty Advisor by discipline area. Each faculty advisor is responsible for all aspects of the cooperative education program for their assigned disciplines. In order to be prepared for success in the workplace, as well as success in the job

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search process, co-op students are required to complete an "Introduction to Cooperative Education" class in their first year. Students begin working with their faculty advisor to initiate the job search process at the beginning of their second year. Throughout their co-op career students meet with their faculty advisor following the completion of each co-op term to reflect upon, discuss, and evaluate past experiences. Students are registered for cooperative education during the quarters they are on work assignment. They are considered full-time students of UC during their co-op work terms carrying zero credit hours.

Assessment of Learning

Both student and employer feedback is collected for each co-op term. Students are required to set learning objectives, complete a focused learning module, and complete a student evaluation for each work assignment. The learning objectives are set in consultation with the student's supervisor and represent the top two skill sets/tasks that the student will be expected to master/complete over the course of the work assignment. The learning module is a self-contained assignment, often requiring some interaction with the student's coworkers, which focuses on one of five topics often overlooked in traditional classrooms: organizational culture, technology in the workplace, professional ethics, theory and practice, and corporate social responsibility. The student evaluation is a comprehensive assessment of the students' work experience for the term.

Employers are asked to evaluate the achievement of the student Learning Objectives and the focused learning module. Employers also complete an assessment of the students that focuses on skill development based upon the work performed during the quarter.

Faculty co-op advisors evaluate student learning as demonstrated by the learning module and review and discuss the objectives and evaluations with the students in individual student meetings following each work term. Traditionally, hard copies of a portion of the employer evaluation have been provided to the engineering departments each term which document the actual work performed as well as the employer's perspective on the relevance of that work to the student's discipline and career goals. Students receive a passing grade for cooperative education if the work experience and the required paperwork are satisfactorily completed. This grade is recorded on the student's transcript.

The assessment instruments used by the division of professional practice were developed using ABET EC 2000 criteria as one of many points of reference. [2] The assessment instruments were designed to be used with engineering programs as well as all other co-op disciplines including those from the College of Business and the College of Design,

Architecture, Art and Planning. Overall, the co-op program uses a three-party assessment system in which evaluations from students, employers, and professional practice faculty members form a comprehensive feedback loop. Many questions that are used in one assessment instrument are mirrored in another so that important assessment data is duplicated from multiple perspectives. In the student's assessment of their professional practice assignment, they are asked to assess the experience itself, their learning from the experience, their skill development, and the co-op position as well as to plan for their future growth and development. Table 1 summarizes categories in which students are asked to evaluate themselves and their co-op assignment. Responses are tallied in a 5-point Lickert scale.

TABLE 1
AREAS ASSESSED BY STUDENT

Student Performance Skills	Co-op Position
Communication	Relation to classroom concepts
Conceptual/analytical ability	Skill development
Learning/theory & practice	Exposure to technology
Professional qualities	Organization culture
Teamwork	Enhance interpersonal skills
Leadership	Identify strengths & weaknesses
Technology utilization	Increased confidence
Work culture	Appropriate supervision
Organization/planning	Work environment
	Clarify profession
	Observe of professionals
	Clarify career goals
	Clarify academic goals
	Increase academic motivation

In the employer's assessment of the professional practice student, supervisors are asked to assess the student's skill development in several key areas as well as the relevance of the co-op position to the student's discipline and career goals. Supervisors are also asked to provide an overall assessment of the student's performance during the work term and to provide suggestions to assist the student's growth and future development. Employers are also asked to evaluate student learning as demonstrated through the learning module assignment on a quarterly topic as well as their mastery of the learning objectives that each student sets each term. Table 2 summarizes areas in which supervisors are asked to evaluate students. Responses are tallied in a 5-point Lickert scale identical to that employed on the student evaluation.

TABLE 2
AREAS ASSESSED BY SUPERVISOR

Student Performance Skills
Communication
Conceptual/analytical ability
Learning/theory & practice
Professional qualities
Teamwork
Leadership
Technology utilization
Work culture
Organization/planning
Work habits

Within each of the general performance areas listed in Table 2, supervisors rate the students in four specific areas.

For example, under the general category of communication supervisors are asked to rate the students ability to “speak with clarity and confidence”, “write clearly and concisely”, “make effective presentations”, and “exhibit good listening and questioning skills”. [3] In addition, supervisors are asked to comment on the general strengths and weaknesses of the student.

Finally, the co-op faculty member provides an overall assessment of the work term. This assessment combines the input from the student assessment instruments, the employer assessment instruments and the individual meeting that takes place between the faculty member and the student following each work term. [4,5,6,7]

THE ON-LINE EVALUATION SYSTEM

The Division of Professional Practice has devised a package of software applications that allow students and employers to complete their evaluations and other assessment instruments on-line. The system consists of three interconnected components, a student module, an employer module and a faculty module.

Figure 2 illustrates how the various software modules and databases interact. Within each of these three components, there exist multiple assessment instruments which feed data into one central database. This central database can be categorized and analyzed to provide learning outcomes data across a wide range of student and employer cohorts and (eventually) over a long period of time for the purposes of longitudinal studies.

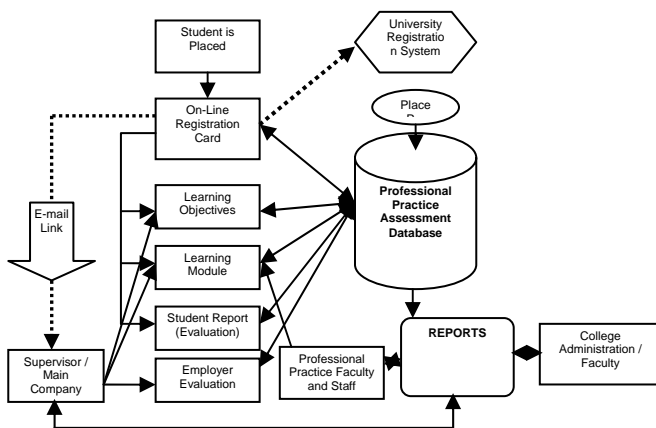


FIGURE 2
ILLUSTRATION OF SOFTWARE FUNCTIONALITY.

Access to forms and data

Students access the main menu of the student module via a login and password protected website maintained by the Division of Professional Practice. Upon entry to the site,

students can select to view documentation for previous co-op assignments, open new and/or partially completed evaluations or documents for their current co-op assignment, or register for a new assignment. Employers access the on-line system through an encrypted link sent to their email accounts. This process avoids the need for employers to remember login names and passwords while still maintaining a reasonable level of security. The employer page allows direct supervisors and/or co-op program managers access to select forms and evaluations for each coop student currently, or previously, employed by them. Both students and employers have access to only those forms appropriate to them. Also, they can edit only those forms active for the current academic term. Completed forms from past quarters can be viewed, but not altered. Co-op faculty have access to all employer and student reports, evaluations, and data. Individual faculty also have access to a summary page which indicates which forms have been completed and which are currently in-progress. At the end of each term, co-op faculty review all documentation and certify their acceptance. This action locks all the forms and associated data into a read-only state within the system, preventing both employers and students from making alterations.

Student module

Student registration for co-op assignments includes scroll down menus of all registered co-op companies, the most current details on company address and contact information, and the most recent contact information for the student. Students have the opportunity to edit incorrect data. This information is then used by the department to officially register each student for co-op with the University. Once students report for work, they are required to return to the website and input the name and contact information, including e-mail address, of their immediate supervisor.

Previous paper documents required of students during each co-op assignment, and now captured using the on-line system, include a one-page declaration of learning objectives set at the beginning of each co-op term and a four page student evaluation completed near the end of the term. In addition, an assigned “learning module”, focused on one of five topics often overlooked in traditional classrooms (organizational culture, technology in the workplace, professional ethics, theory and practice, and corporate social responsibility) is completed.

Employer module

The Employer module has two parts, one for the main company contact and one for the students’ direct supervisor. Near the end of each co-op term, the direct supervisors of each co-op student are sent an encrypted link with an embedded ID and password that allows them to log directly into the system. The direct supervisor can view the students’ completed learning module and access the online forms covering the

employer evaluation and employer assessment of learning objectives. Employers are not able to view students confidential comments related to the co-op work assignment, as UC places a high value on encouraging honest feedback from students regarding their co-op positions.

The main company contact, often an HR person responsible for the employer's entire co-op program, can view the evaluations for all students working for their company, view placement history, and view and update company job descriptions. They can also alert co-op faculty of impending employment needs.

It should be noted that students have read-only access to their supervisor's assessment of their performance. Likewise, supervisors have read-only access to those portions of the student assessment they have access to.

Faculty module

Individual faculty of the Division of Professional Practice have access to both student and employer forms through a login and password protected web-page. Once accepted into the system, they are presented with a screen that allows them to view data, evaluations, and documentation for only those students assigned to them. Faculty have access to all employer and student forms associated with each student they are assigned. They can view any assignments or evaluations for current or past terms. In addition, this module provides email functions that allow faculty members to send reminders to those students and employers who have yet to supply assessment data. The module also has a strong reporting capability that enables all faculty members to view reports of aggregate student learning data. College faculty and administrators have the ability to view reports in real time that would have previously required significant time and effort on the part of the co-op office to compile and analyze.

The software

The application was developed using ASP vbScript, JavaScript, HTML, and SQL coding. The ASP code is used to make the pages that load for the student, employer, and faculty member to be dynamic. The ASP runs on the Division of Professional Practice server and, based upon the user-type, actually creates an HTML document that will be specific to that user. Certain aspects specific to the logged-in user change the page that is displayed and the options that are available to that user. JavaScript is used to allow for common user interaction elements such as alerts, pop-up windows, data validation, and other display options after a page has been loaded. Lastly, the SQL is the intermediary between the MS Access database and the ASP code. It saves user data, creates and edits tables, adds and deletes records, and pulls information from the database.

The application modules were created and stored in a MS Access database as a table, which allows for dynamic editing. The answers to the modules are stored in separate tables which links students' answers to a specific module table. This allows a program called Crystal Reports to easily create reports in .pdf, excel, and other easily manageable document types. The modules provide an extra dimension of data collection and reporting capability that was not possible before with hard documents. Now questions can be asked based upon a quarter, student's major, class year; pretty much anything at all. In addition, the data can be easily saved and analyzed.

Implementation

As of March, 2004 the system has been employed for two academic quarters. The first quarter (Fall, 2003) was a trial quarter that only included engineering and digital design majors. This trial quarter helped to bring about important changes to the underlying structure of the system. More capability was added, and some data was converted from ASP to SQL in order to work more smoothly with the Crystal Reporting program.

During the two initial quarters of implementation, approximately 5% of employers experienced some kind of difficulty in accessing and completing the on-line forms. For students the number was approximately 10%. Most of the difficulties encountered were events that were not preconceived such as broken links. Others were problems caused by the students; such as entering invalid email addresses for themselves or their supervisor. The frequency of these errors did lead to some coding changes as well as an increased emphasis to the students of the importance and need for accurate reporting of supervisor and personal emails when registering. Because of the extensive use of the system during the most recent term (Winter, 2004), errors are becoming rarer and are expected to be well below 1% for employers during the upcoming Spring term.

Over the next 6 months, the reporting aspects of the system will expand. Reports for the Division, the University of Cincinnati, and various employers will be developed. In addition, new co-ops working on the system will add new capabilities and user types to the system to further increase its usefulness.

Potential impact

This online evaluation system currently being implemented at the University of Cincinnati will improve the efficiency and effectiveness of student learning assessment in the co-operative education program, particularly on a programmatic level. However, the impact of this assessment data will be felt beyond the offices of the Division of Professional Practice. Since participation in the co-op program is a mandatory part of the undergraduate curriculum in the College of Engineering, learning outcomes documented through use of this system are relevant to the accreditation process of the undergraduate

engineering programs. Most, if not all, of the student performance areas assessed by both the student and supervisor evaluations (see Table 1 and Table 2) correlate directly to items a through k of the ABET Criterion 3 “program outcomes and assessment”. [8] It is expected that one of the first uses of the data now being collected will be to provide documentation to College of Engineering department heads for many of the criterion listed in Table 3.

TABLE 3
ABET OUTCOMES AND ASSESSMENT CRITERION 3
Graduates must demonstrate an ability to:

A	apply knowledge of mathematics, science, and engineering
B	design & conduct experiments and analyze & interpret data
C	design a system, component, or process to meet desired needs
D	function on multi-disciplinary teams
E	identify, formulate, and solve engineering problems
F	understanding of professional and ethical responsibility
G	communicate effectively
H	the impact of engineering solutions in a global & societal context
I	recognize the need for, and to engage in, life-long learning
J	a knowledge of contemporary issues
K	use the techniques, skills, & modern engineering tools necessary for engineering practice

Potentially more valuable than the usefulness of this system for program assessment is the ability to manipulate data for the purposes of research. In the past, research of cooperative education programs has primarily focused on the career success of candidates, focusing on items such as number of job offers, starting salaries, and early career promotion (see Johnston, et al., page 159 for examples). [9] It is hoped that in the near future, data collected through this system coupled with the analytical flexibility of the database will allow meaningful research on the value of co-operative education as an academic program.

Questions of interest to co-op faculty include:

To what ABET outcomes do cooperative education and internships most significantly contribute?

Do students who participate in a cooperative education program “score” higher in any of the ABET criteria than students who do not?

Is it possible to compare the effectiveness of co-op versus differing experiential education programs in producing students who meet ABET criteria?

The data needed to answer many of these, and other equally important questions, will require collaboration with multiple institutions including those who have cooperative or internship programs and those that do not. The faculty of the Division of Professional Practice welcomes suggestions and ideas for such collaborations.

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