

Building Future Careers: A Co-op Course Reimagined

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Since graduating with a Master of Architecture Degree from Harvard University, I have dedicated my professional career to environmental conservation, sustainability, green-building design and the creation of innovative degree and certificate programs, professional development seminars, and industry trainings that feature experiential learning activities.

My work with the higher education sector includes the development of green building-related policies, master planning, management for energy conservation/renewable energy projects and space planning for campus expansion. As a senior administrative leader, I have facilitated climate action planning in compliance with the American College and University Presidents' Climate Commitment (ACUPCC) and received the Outstanding Climate Leadership award that recognized successful carbon reduction strategies, innovative curriculum and the dynamic engagement faculty, staff and students in the pursuit of carbon neutrality.

Although my primary formal training has been in the field of architecture, recent doctoral studies at the University of Pennsylvania were focused in the field of higher education management. As part of an international research team, I had the opportunity to work with senior leaders at Nazerbayev University, KIMEP University and Kasipkor, a holding company establishing 2 new colleges (Astana) and 4 interregional centers (Atyrau, Ust-Kamenogorsk, Ekibstuz and Shymkent). My research team Technical Vocational Education Training (TVET) focused on examining the technical education system that is seen as a catalyst for the country's ambition to be an international leader in the emerging green economy.

My doctoral research explores the similarities and differences of physical and virtual place making, and the extent to which the approach may impact the learning experience for students and/or the shape of online learning spaces in the future. My belief is that just as there is a need for public parks and squares to be pleasant and welcoming to a diverse population in order to function effectively, so must the interfaces and places in the online classroom environment, be designed to engender meaning and afford social interactions. I invented several analysis tools for measuring the embodiment of course materials, the flows of communication and information, and the "sense of place," using frameworks such as the Vitruvian Triad and the concept of tacit knowledge and Vygotsky's Zone of Proximal Development.

Since the notion of a "sense of place" is not well understood outside the design fields, my recent research seeks to define the concept within the realm of virtual learning environments and to fill gaps in knowledge related to describing virtual places in terms of their proximity (distance), co-presence/embodiment (the feeling of being together), visibility (can you see other people), and territoriality (control/ownership of space).

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Abstract

The College of Engineering at Northeastern University has recently and rapidly expanded its graduate programs and seen a dramatic growth in numbers of students. Our University has a distinct history of undergraduate experiential learning that integrates theoretical knowledge and professional experience, making cooperative education (co-op) an essential element of its objectives. The graduate co-operative education program was initiated eight years ago and has experienced great and rapid growth. As part of effort to create a strategic vision for the future, the Co-operative Education Team undertook a dramatic re-evaluation of the graduate programming that included a review of recent research and literature regarding the skills, knowledge, and attributes required for success in the 21st century workplace. One discovery was a lack of assessment data used in the planning and decision making processes. Another identified challenge was a lack of research targeting the international student demographic, which is the majority for the multidisciplinary masters programs at our institution. The primary finding, however, was a need for a complete redesign of the “Introduction to Cooperative Education” course.

This paper documents the discovery process and includes a summary of the literature and research, feedback from industry partners, and observed trends in U.S. employment sectors that impact the changing needs of the engineering profession. The course name was changed from “Introduction to Cooperative Education” to “Career Management for Engineers” to reflect this new focus. Along with a new name, came new objectives and learning outcomes. The revisions transformed the one-credit course from being a short-term focused “nuts and bolts” skill building class, to a long-term focused, comprehensive career management resource. The authors share their experience with selecting new materials, creating lesson objectives, assignments, resources, and developing lesson outlines that all map to the new course objectives and learning outcomes. This paper includes examples of the course study guide, sample educational lessons, assignments and plans for assessment, as well as suggestions for continued improvement.

The Original Course

The original course was developed in the fall of 2009 and was administered in a pass/fail format. Faculty and students met for eight, 45-90 minute sessions during the semester and to be honest, the curriculum was not rigorous, and there were no required textbooks. Students passed the course primarily by showing up for six of the eight lessons and submitting two ungraded assignments that included a one-page career goal paper and a one-page resume. The class was taught in a large classroom space to sections of 75-90 students and was presented in a traditional lecture style format. This course was designed to introduce graduate engineering students to the University’s Cooperative Education Program and focused on developing skills in managing workplace expectations and requirements, resume construction, interviewing, and professional ethics. Employer panels were sometimes used to explore employment opportunities within the fields of engineering. Peer-based discussion panels allowed students to share stories about how they found their job and their experience as an employee. The stated course objectives were as follows:

- a. Understand the Co-op program, policies and expectations.
- b. Understand how to use the university website in order to access on-line information used in their job search process.
- c. Identify and describe their skills and work values and how they relate to their career choices.
- d. Learn how to write and critique a resume.
- e. Learn and practice proper interviewing skills and techniques.
- f. Communicate their interests, skills, needs and future plans to their Co-op Coordinator and future employers.

The primary focus of this course was on finding a co-op job. Lessons included topics such as “ethics,” which featured case studies from the National Society of Professional Engineers (NSPE), and topics such as the “workplace in the United States.” Each lesson included anecdotal stories of students in hypothetical situations. According to survey responses, the course was well received largely due to the fact the professor was very personable and a good storyteller. In a standard University end of course survey only approximately 50% of the students responded and while their response to questions about the course on a 1-5 scale were usually in the 3.5-4.0 range, they noted the course was not challenging and students often asked for more feedback on their work. There were some complaints that the course should not be required and some expressed disappointment that it did not teach them anything that was not available online.

The overall goals of this course were consistent with strategies deployed in the University’s acclaimed undergraduate programs. Yet one significant difference from the undergraduate program was a lack of personal contact between faculty and students, which has long been a hallmark of the undergraduate program. This was due primarily to the vastly larger faculty student ratio in the graduate programs (approximately 145:1) and the limited time in the graduate program (generally two years versus five).

Reimagining Co-operative Education

The redesign of the course coincided with a University-wide initiative to reimagine cooperative education with a primary goal of “helping students maximize learning by being more intentional about learning in Co-op and in the transfer of that knowledge and experience to and from their academic experience.”^[1] There were two main objectives for the new vision. The first goal was to link experiential learning activities with all phases of experiential learning theory such as reflection, observation, abstract conceptualism and active experimentation.^[2-4] This process ensured consistency in the co-op programming throughout the University and alignment with established learning theories. Thus, student-learning outcomes for all experiential learning experiences (Co-op, service learning, global experiences, and student research) offered at the University were as follows:

1. *Apply* knowledge and skills in new, authentic contexts, thus gaining a deeper understanding, i.e., recognizing what to use, how, and when;
2. *Gain* new knowledge and *develop* new skills to successfully engage in unfamiliar tasks, activities, etc., thus gaining the ability needed for continuous, life-long, self-directed learning, i.e., recognizing what they don’t know and figuring out how to learn it or compensate for it;

3. *Integrate and use* the deepened knowledge and skills as well as the newly gained knowledge and skills to continue to learn in their academic programs; and
4. *Reflect on and articulate* the above, i.e., discussing how they used their knowledge and skills, how they gained new knowledge and skills, and how “theory and practice” work together, thus developing skills of metacognition, another element of life-long, self-directed learning ^[5].

In addition, the secondary goal of the co-op course was to promote self-directed learning. This was to be accomplished by the pursuit of answering four thematic questions:

- What do I already know?
- What do I think I know?
- What do I need to know?
- What would I like to know?

Cooperative Education Program Background

As co-op faculty, we work closely with students in search of co-op opportunities and with employers looking for employees with specific skill sets that add value to their business and accomplish the work and mission of the firm. By working with both groups, we have gained a clear understanding of market trends, specific technical skills sought by employers, and expectations particular to the workplace in the United States (U.S.) from the perspective of both students and employers.

Demographic Data

Other important influences on our course design were the demographics of our student body and the unprecedented growth in multidisciplinary masters degree programs at Northeastern University. For instance, in the entire U.S., the growth of international graduate engineering students increased at annual average growth rate of 2.7% between 2003 and 2013. And the average annual growth rate was 3.3%, between 2008 to 2013 ^[6]. However, our University has experienced a 97% increase in graduate engineering student enrolment in the past 5 years. In fact, international students make up 87% of our most recent class, up from 68% five years ago, and their numbers have increased 153% over the past five years. Our students come mainly from developing, non-English speaking countries. For instance, over the past five years, 32% of students came from China and 32% from India and the remaining 15% of international students came from the rest of the world, with no other single country supplying more than 1% of the total.

In the Graduate School Engineering, there were 2637 students last year (academic year 2014-2015), of which 83%, or 2194, were international students. This included both Master of Science (MS) and Doctoral (PhD) programs. International students attend our University to pursue masters and doctoral degrees in traditional disciplinary majors (bio, chemical, civil, computer, electrical, industrial, and mechanical engineering as well as operations research), and also to pursue multidisciplinary professional master’s degrees in energy systems, engineering management, information systems, sustainable building systems, and telecommunication systems. Our Co-op course was developed specifically with the international students from these

multi-discipline masters programs in mind. To be clear, international students represented 96% of the students in our course in 2014-2015 (Table 1). These professional graduate programs require completion of about 32-credit hours of coursework during the course of approximately 24-30 months. Based on interviews with students, most students chose to attend our University to have the opportunity to pursue an experiential learning experience through co-op. The growth of demand for co-op can be seen in the course growth plotted in Chart 1—Co-op course growth.

Gender	Number	Percentage
Male	345	67%
Female	169	33%
Country		
India	354	69%
China	101	20%
Brazil	17	3%
US	20	4%
All Others	42	8%

Table 1 – Co-op Course Demographics 2014-2015

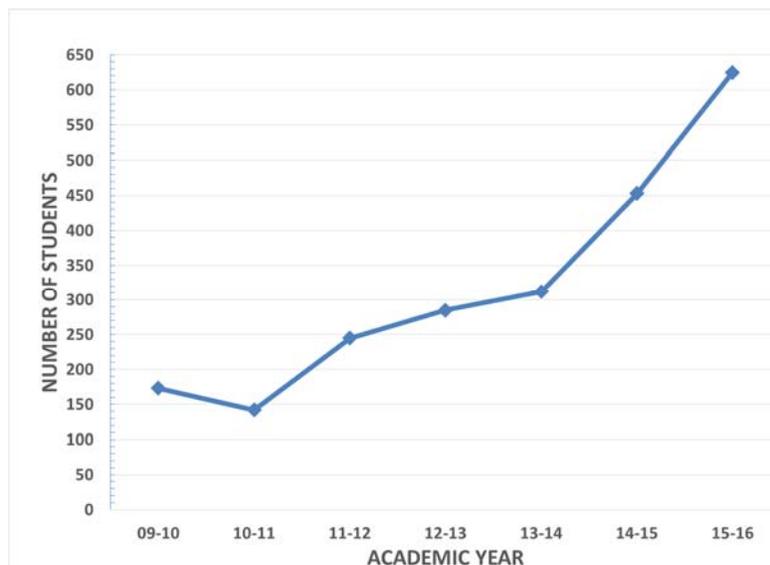


Chart 1—Co-op course growth

Employers and Placements

Our employer partners are diverse. They represent large Fortune 50 companies; start up technology and biotech companies, and everything in between. They represent for profit companies and not for profits. They represent all sectors of the economy and our students compete for co-op placements in Boston and around the U.S. In the Academic year 2014-2015, we had 231 students on co-op work experience and in academic year 2015-2016 we had 368 students on co-op, and increase of 59 %. Students are allowed one (1) co-op experience, not to exceed 8 months, while in the two-year professional master’s degree program.

Co-op placements are competitive for both the student and the employer. The co-op is a voluntary option for students in the multidisciplinary master’s programs, and about 55% of students are placed each year, although there is a variance by program (see Table 2). Graduate co-ops earn approximately \$20-\$35 per hour for full time work, which may be performed for up to an eight-month period. Successful partner companies articulate and define the skills needed by co-ops and successful students are able to demonstrate they possess in demand technical skills but also an understanding of U.S. workplace values of accountability, teamwork and ethics. Successful companies are beginning to see the need to shift their employment requirements to specific in-demand technical skills. Although many companies and human resource experts have compiled lists of in-demand skills, for student use, two divergent trends are emerging with regards to skill matches. First, as developed economies emerge from the 2009-2011 recession, job vacancies increased but their unfilled job rates did not decrease and in some cases, they are going up. It should be noted that students who are looking for their first job or a co-op experience to enhance their professional success are particularly affected by these conditions.

Program	Average Placement Rate	Total number participating per year
Energy Systems	55%	3-19
Engineering Management	30%	17-74
Information Systems	85%	38-104
Telecommunications	65%	26-74

Table 2 – Placements by program 2011-2015

Consistent with our experiences, many companies also no longer train new employees. Productivity is seen as a key business measurement and the consensus is that more is needed to bridge the gap between existing skills and what employers demand. According to Paul Harrington, Director of the Center for Labor Markets and Policy at Drexel University, employers evaluate candidates on 4 critical skill categories. First is academic skill, mostly reading, writing and math at a level commensurate for the job. Second is occupational skills; those skills necessary for success in a certain job. Third is workplace skills, these are usually referred to as soft skills. Live Career.com has compiled a list of the top 10 skills in demand in today’s global economy, notably many are what are considered soft skills that are not often included as a focus in university-level coursework. Soft skills include communication skills, interpersonal skills, adaptability, and emotional intelligence.^[7] Companies are increasingly focused on these skills as they look to hire these new employees and not have to train for them. Finally, employers want character traits. These are skills like work ethic, honesty, punctuality, and dependability.^[8] We have observed a similar phenomenon in our practice, as increasing numbers of employers ask about these skills. “Knowing which skills are in high demand can help guide decisions around education and work experience,” says Brent Rasmussen, President of Career builder.^[9]

New Approaches

Cultural Considerations

It may seem farfetched, but we are exposing some students to soft skills such as interview skills, resume writing and creating a professional profile for the first time. Many of the international

students in our programs struggle with written and spoken English and with cultural differences common in US workplace. Many of our employers seek out our students for potential co-op employment opportunities because of their advanced technical skills, but sometimes feel frustrated with their communication skills. As a result, we continue to incorporate employer feedback on how we can improve students' written and oral communications.

Because of language issues, we included several written assignments in the revised course. We now provide extensive feedback both on content and language usage in these assignments and we also take time in class to discuss “phrases that we do not use in the workplace”, how professional colleagues are to be addressed, expected body language, and other aspects of clear communications that are often taken for granted by those native to the United States. Our aim is not to replace or change their own communication patterns and skills (which can be appropriate in other English speaking parts of the world), but to supplement them and allow them to choose the most appropriate manner to communicate to an audience based on the context in which they find themselves. Appendix A provides the course syllabus, list of assignments, as well as the mapping of course learning outcomes to each lesson.

Since most students will ultimately seek and hold jobs throughout their lifetime, using a long-term approach to the new course materials was a practical decision. We wanted to help the students become self-directed learners while also understanding the big picture. In an effort to foster the transfer of this knowledge, we introduced specific learning objectives for the course, selected new textbooks and developed lessons on topics such as mindset, mindfulness, motivational theory, diversity issues, and ethics in the workplace. For instance, Carol Dweck's Mindset, a required text, explains the concept of fixed and growth mindsets. Dweck and others have found that significant numbers of school-age children believe that ability is fixed, particularly in STEM areas, and that these beliefs predict achievement.^[10, 11] We applied these research findings to emphasize that talent and ability are starting points to understanding how to best approach success, failure, and challenges with a growth mindset. In addition, classroom discussions highlight the fact that students will not always be successful in their job search but that their approach to resiliency can greatly impact their eventual success. Dweck and her research colleagues have also found that the messages students receive from teachers from preschool through college impact their mindsets, their goal orientation, and, consequently, their academic achievement.^[12]

Our practice has shown that other important traits employers are looking for are engagement and integrity. Thus, the course also utilizes Ellen Langer's book, The Power of Mindful Learning, as another text. By trying to help the students learn the value to being present and more mindful in all they do we hope to foster engagement. New lessons in the co-op course also intentionally focus on embracing the new and novel, looking for connections and patterns, and striving to make work like play.^[13]

One interesting connection of the concept of mindfulness is to honest behavior, which is related directly to ethics); an important aspect of academic work, and of particular relevance to engineers whose conduct is governed by the National Society of Professional Engineers. A group of researchers hypothesized that “when people attend to their own moral standards (are mindful of them), any dishonest action is more likely to be reflected in their self-concept (they will

update their self-concept as a consequence of their actions), which will in turn cause them to adhere to a stricter delineation of honest and dishonest behavior. However, when people are inattentive to their own moral standards (are mindless of them) their actions are not evaluated relative to their standards, their self-concept is less likely to be updated, and therefore, their behavior is likely to diverge from their standards.” In experiments where people were given clues to cause them to be more mindful of their ethical standards (mentioning the Ten Commandments or a school Honor Code) they confirmed their hypotheses and saw a reduction in cheating or dishonest behavior.^[14]

As a result of our research and emerging best practices regarding academic integrity, we made a conscious decision to check for and enforce all University policies concerning academic integrity violations involving plagiarism violations. We implemented an academic penalty (zero points on an assignment), report each suspected case, and have a zero toleration policy for plagiarism. We required students to submit all written assignments through Turnitin software, and allowed them to see the results. One obvious reason for concern comes from the National Society of Professional Engineers Code of Ethics, which states:

“Section III. Professional Obligations. Item 9. a. Engineers shall, whenever possible, ***name the person or persons who may be individually responsible for*** designs, inventions, ***writings***, or other accomplishments”^[15] (emphasis added).

Integration of Motivational and Learning Theories

Motivational and experiential learning theories are also utilized as recurring themes in the course, in an effort to get students to understand extrinsic and intrinsic motivation and the varying levels of extrinsic motivation.^[16] For instance, we introduce perspectives shared from Daniel H. Pink’s book (*Drive*), Ted Talks (*The Puzzle of Motivation*), and videos (*The Surprising Truth about What Motivates Us*) that focus on universal desire for purpose, connectedness, mastery, and for autonomy.^[17, 18] These tools facilitate an understanding of the connections between career goals and job search strategies.

Philosopher John Dewey, one of the founding scholars of experiential learning, recognized that experience alone did not produce learning. He emphasized that learning involved “that reconstruction or reorganization of experience that adds to the meaning of that experience and which increases ability to direct the course of subsequent experience.” He argued that it was necessary to reflect on experience in order to draw out the meaning in it and to use that meaning as a guide in future experiences.^[19] The redesign of the co-op course also reflects and interprets Dewey’s ideas in several assignments. For instance, one lesson includes an assignment that requires students to define their career goals (learning outcomes) and how they will be different because of a given learning experience. This planning process requires self-assessment and evaluation. Students must describe their career goals, what they already know, what they think that they know, and what they need and want to know.

Administrative Management Strategies

We made several seemingly small decisions with the aim of replicating conditions in the US workplace, encouraging better written and oral communications skills, and in building confidence

of the students to set realistic expectations. For example, requiring regular attendance and punctuality are expected in the workplace, so we made the same expectations for students enrolled in the course. We also encourage students to plan ahead and inform their instructors of these absences, preferably before missing the class, much as they would with an employer. Even though this is a one-credit course, we still required students to complete and submit specific assignments and/or quizzes to Blackboard, the University's selected learning management system. The quizzes are straightforward for those who have done the reading, and another step designed to foster good habits and preparation for the workplace.

Another significant change we made to encourage participation and engagement was the use of polling software (Turning Point) that encourages participation, serves as a springboard for discussions, and supplements direct questions and classroom discussions in a less threatening manner. The software also helps to build social confidence, as students learn to interact with their peers and with faculty in a group setting. The reduced student/teacher ratios in smaller classrooms also allowed us to bring in more activities and small group activities into the classroom to foster more interactive learning.

The Act of “Making” as a Metaphor

As part of the new course design and acknowledging the primarily international student population in our course (96%+), we created course materials to help convey ideas in a logical and organized manner. We also developed a metaphor for those participating in the course comparing it to the act of making something, such as building, prototype or simulation model. We have reinforced this concept by including targeted graphic images (see Appendix B), to provide a visual reference for the analogy of “building a career.” For instance, we compare students' career goals to architectural plans/blueprints. The students' background and experience are compared visually to the foundation of a building. The “materials” required to find a job are analogous to the tools required to make the buildings. Finally, the attitudes we want them to develop to make them successful in their endeavors are compared with physical columns found in the structural systems that actually support buildings.

Each student also receives an extensive study guide manual that provides them with lesson plan objectives, study assignments, homework requirements, and a variety of supplemental materials. An example of the study guide material for one lesson is found in Appendix D. This material, and special small group activities conducted throughout the course, support the processes discussed in class (career goals, job search strategy, learning outcomes for a job), as well as the products (resumes, LinkedIn profiles, cover letters, etc.). Appendix C is an example of a connections map we use to facilitate discussions on the connections between various processes and tools that are taught in class to foster deeper learning.

Assessment Plan

We believe that comprehensive assessments provide data that is the foundation for continual improvement. Unfortunately, during the first eight years of the multidisciplinary master's degree co-op programming, there were no systematic assessments. However, we were able to examine job placement history to a limited extent. As a result of the lack of data, we felt it was imperative to develop and implement a system of assessments for both the Co-op course and program. With time and experience the amount and type of information we are collecting has

grown as we have learned what information we need and what would be useful. The assessment has three primary components:

End of Course Survey Instrument

We instituted an end of course survey consisting of 25 questions, based largely on questions used at the US Military Academy, West Point and in the Department of Civil & Mechanical Engineering there. This instrument was selected because it provided more in-depth questions about the students learning experience and the instructors' role in the course, in comparison to the current University end of course survey. We are looking for feedback on the instructor and on the course content. For instance, in the survey, we ask about the instructor's effectiveness, ability to serve as a role model, course organizational and presentation, usefulness and relevance. As part of this assessment, we also collect data on the students' past experience and demographics.

Time Surveys

In addition to the end of course survey, we collect data throughout the semester on the amount of time students spend between lessons working on the course. (See Chart 1 – Course Time Survey). This metric allows us to monitor assignments and to provide another input to check that students are neither over taxed nor under challenged.

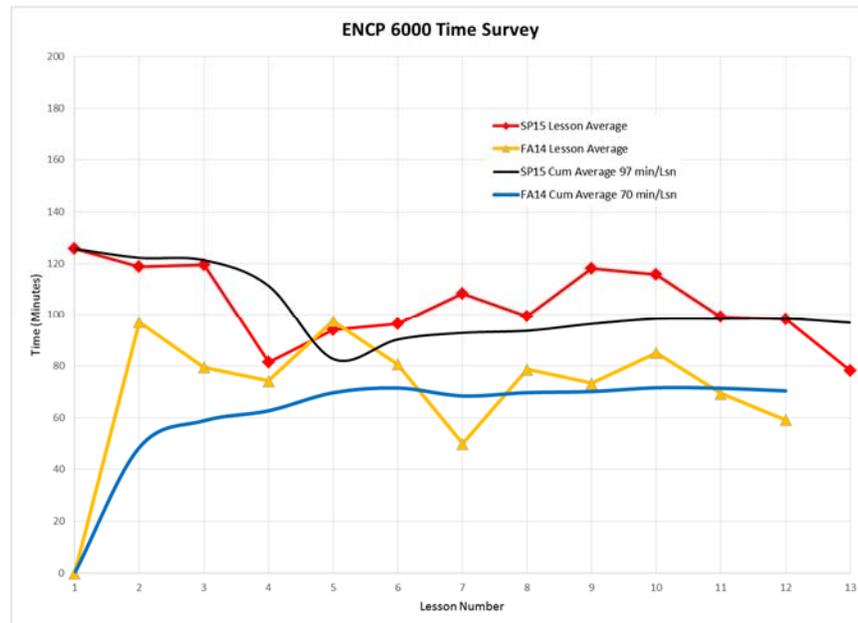
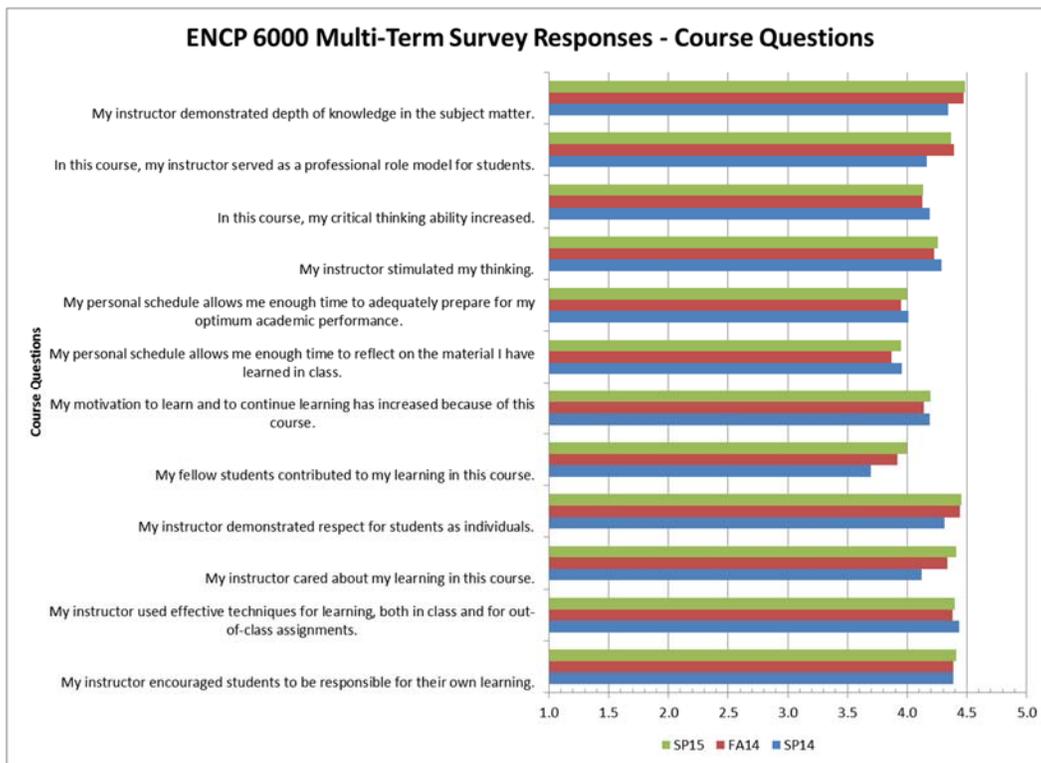


Chart 1 – Course Time Survey

In the first year we received an 88% response rate from the students on the course survey's, a large improvement from the past years responses to the University survey. This response rate was higher than the 50% response rate seen in the previous Intro to Co-op Class and in the universities own course wide survey. Overall, the feedback has been encouraging and positive (see Chart 2 and 3 for representative feedback). We also asked the students what they liked about the course, what they would change and provided an opportunity for them to provide any

comment they desired. Most of the survey respondents provided narrative feedback on the course. The overwhelming response from students displayed satisfaction with the course and many had no recommended changes or expressed a desire to keep the course as it is. The vast majority also indicated that they felt it provided them with many useful tools and knowledge that would make them successful in the workplace and in their careers. In contrast to 2009, no student expressed the work not to be challenging, or that they could have learned the material on line. We did receive a significant number of comments that the course helped improve the students' writing skills, over 5% made specific comments to that effect. Aggregate course scores in 2009 were 3.5-4.0, on a 1-5 scale. In 2014-2015 aggregate scores were 4.0-4.5. In other areas, students commented that their critical thinking skills had improved in the course and now average 4.2 in student responses. All students rated their ability to compete for a job and work in the US on average as 4.3. In addition, we received some useful suggestions, for example, we received comments from over 15% of the respondents requesting mock interviews or more opportunity for interview practice with feedback.



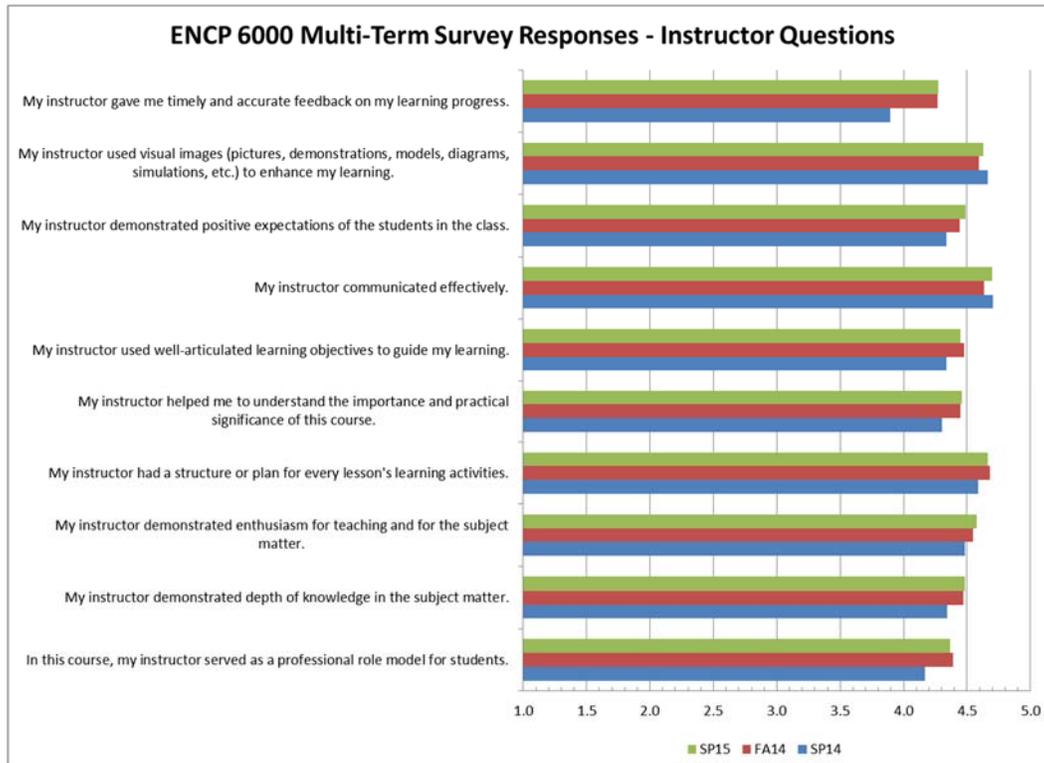


Chart 2 &3—Course survey feedback.

Co-op Assessment

We have also set up an assessment plan for students who obtain jobs as part of the co-op program. In this assessment we collect information such as their country of origin, how much past and relevant work experience they have, the quality of their resume, how many courses they have completed, and when they took our course. We also collect specific information in reference to the job offer to better understand when the offer was made, the wage, location and length of the position. Collecting and analyzing this data provides a more comprehensive picture of the current student experience in our classroom and in the workplace. As an example, we discovered a mismatch between our typical student's employment background and the level of experience of those receiving job offers (See Chart 4—Comparison of experience between all students and those hired.) This disparity provided an opportunity to work with our program directors to modify existing content and to include more project based learning activities in an effort to provide students with experience that employers seek.

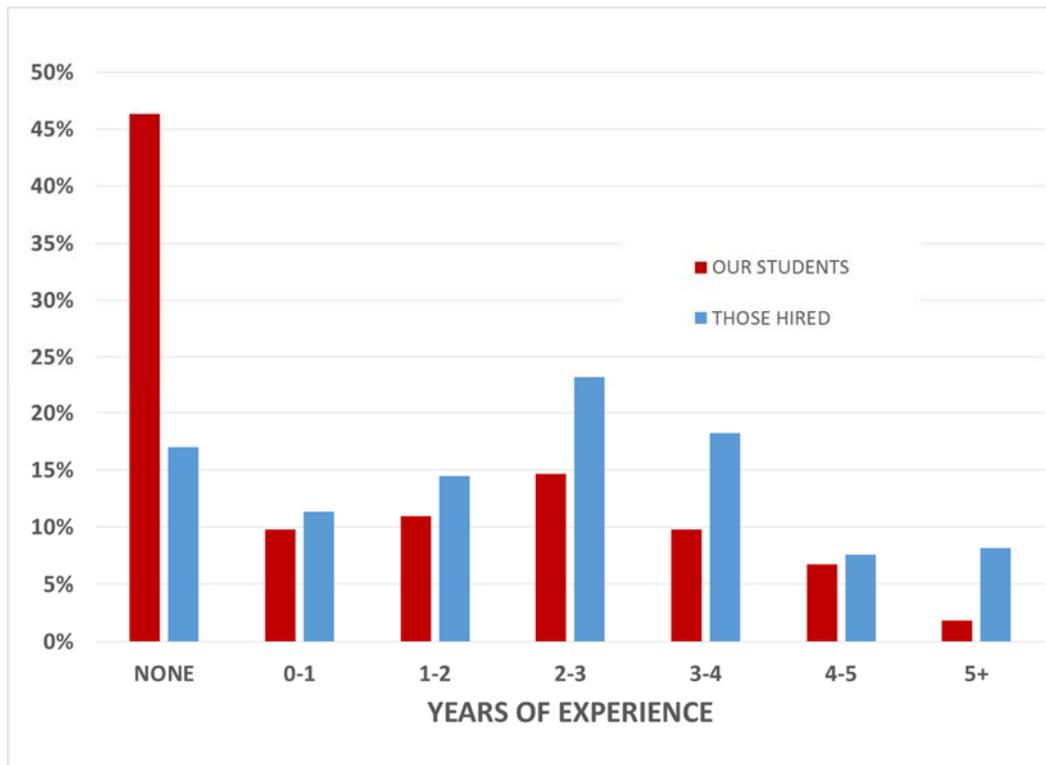


Chart 4—Comparison of experience between all students and those hired

Additional Notes on Assessments

The University also requires students to fill out reflections three times during the co-op experience and also when they return. Due to the volume of students in the graduate professional masters programs the limited amount of dedicated full-time co-op faculty, there is no time to respond to the students’ reflections or for a comprehensive analysis of this feedback.

We also conducted time studies that identify the average amount of time required for teaching, grading, student meetings, plagiarism issues, placements, reviewing reflections and providing feedback, and work experience assessment. This process of continual assessment helps to ensure faculty members have the resources they need to properly serve the students, and to determine the needs for additional teaching assistance/faculty in the future.

Findings and Future Steps

We are convinced that the redesigning of the cooperative education course has been a step in the right direction. Focusing on long-term career management prepares students for both the co-op experience and the jobs they secure in the future. The development of a robust assessment program will allow us to monitor and make continual adjustment and improvements in a rational, data driven method to ensure the course remains relevant and appropriate for our students. It will also help to justify acquisition of new faculty for the program, or other resources to ensure the level of quality consistent with our University.

Moving forward, we envision a more systematic use of the data that is collected with statistical programs such as SPSS that allows descriptive comparisons of frequency counts of closed questions and distributions of answers in terms of assigned criteria. The first assessment of the new course redesign yielded an enormous amount of data, and the conclusion in this report represent a general summary of the findings. To be more accurate, we could, for example, be more aggressive with the coding of the responses to questions such as, “What did you find useful about the course?” This would allow us to quantify the open-ended responses and get more of a relative sense of the frequency that would also allow us to explore the relationships between responses to different questions. With a finer level of data collection, we could also create dynamic graphic presentations of the questionnaire data for reporting, presentation, or publication.

We also sense that there is an opportunity to utilize technology, where appropriate, to address challenges of capacity and student engagement. For example, utilizing software programs such as Voice Thread, Audacity, Blue Jeans and Camtasia would create more diverse learning experiences for students. We have also started to explore Respondus, an authoring tool designed to increase flexibility in how exams are offered and administered by reducing the time required to create large banks of randomized test questions. Future revisions to the course could include taking the concept of the “Graphic Syllabus” (Appendix B) to the next level. For example, we could revise the syllabus documents and also the study guide manual to include many more images, and reimagine these materials in the style of a graphic novel. A renewed emphasis on a visual delivery of the educational content seems especially appropriate, given the international student population, and the observed struggle with language and communication skills, in general.

Other possible strategies to help students could involve flipping the classroom and providing targeted on-line modules, as well as creating a video library of peer and employer panels, student testimonials while on co-op, and other career resources

Appendix A – Sample Syllabus and assignments, matching learning outcomes to lessons

LESSON	TITLE	ASSIGNMENT DUE	Supported Course Objectives
1	Introduction to Co-op—What is grad co-op? Developing Career Goals Positioning Statements		a, b
2	Resumes I	Career Goals, Policies Quiz 1	b, c, d
3	Resumes II Career Fair Preparation	Positioning Statement, Draft Resume	b, c, d
4	Job Search: Tool and methods to find a co-op job		b, c, d
5	LinkedIn & Cover Letters	Resume*	b, c, d
6	Mindset & Networking Letters	Cover Letter, Mindset Quiz 2	b, c, d, e
7	Mindful Learning & Motivation	LinkedIn Profile, Mindful Quiz 3	b, c, d, e
8	Interviewing & Thank You Letters	Mindset Quiz 4 Interview Prep Assignment	b, c, d
9	US Immigration Policy, Visas, and why we need to know about them (both US Citizens and those from other countries!)?	Get Informed: Sexual Harassment Awareness for NU Students Module	D
10	Engineering Ethics	Ethics Quiz 5, Ethics Case Prep	c, d
11	Planning a successful co-op and when and how to select the right co-op.	LO/DEL Quiz 6	b, c, d, e
12	Professional Behavior Diversity in the Workplace	Mindful Quiz 7, Learning Outcomes*	a, b, e
13	Summary		a, b, c, d, e

Course Learning Outcomes:

- a. Explain and justify the value of cooperative education for you.
- b. Create your own career goals and identify the experiences that you want to have during your cooperative learning experience *and after* to further those goals. Identify and evaluate various motivators that drive your decisions.
- c. Articulate your own skills and abilities for a variety of audiences and identify areas for development.
- d. Apply appropriate skills and knowledge to find and obtain a co-op position.
- e. Apply appropriate skills and knowledge to find and obtain a co-op position and/or a position after graduation and throughout your career.

Appendix B – Graphic Syllabus



Any building starts with a good set of plans.
Lesson 1: Career Goals & Positioning Statement



Good tools are essential for construction.
Lessons 2 – 5, 8 & 9: Resumes, LinkedIn Profiles, Professional Correspondence, Interviews, Visa Policy, and Job Search Skills



Columns support the weight of a structure, and likewise it is the fundamental attitudes and attributes that will support your career.

Lessons 6-7, 10-12: Mindset, Mindful Learning, Motivation, Ethics, Diversity, Professional Behavior, Deliberate Experiential Learning

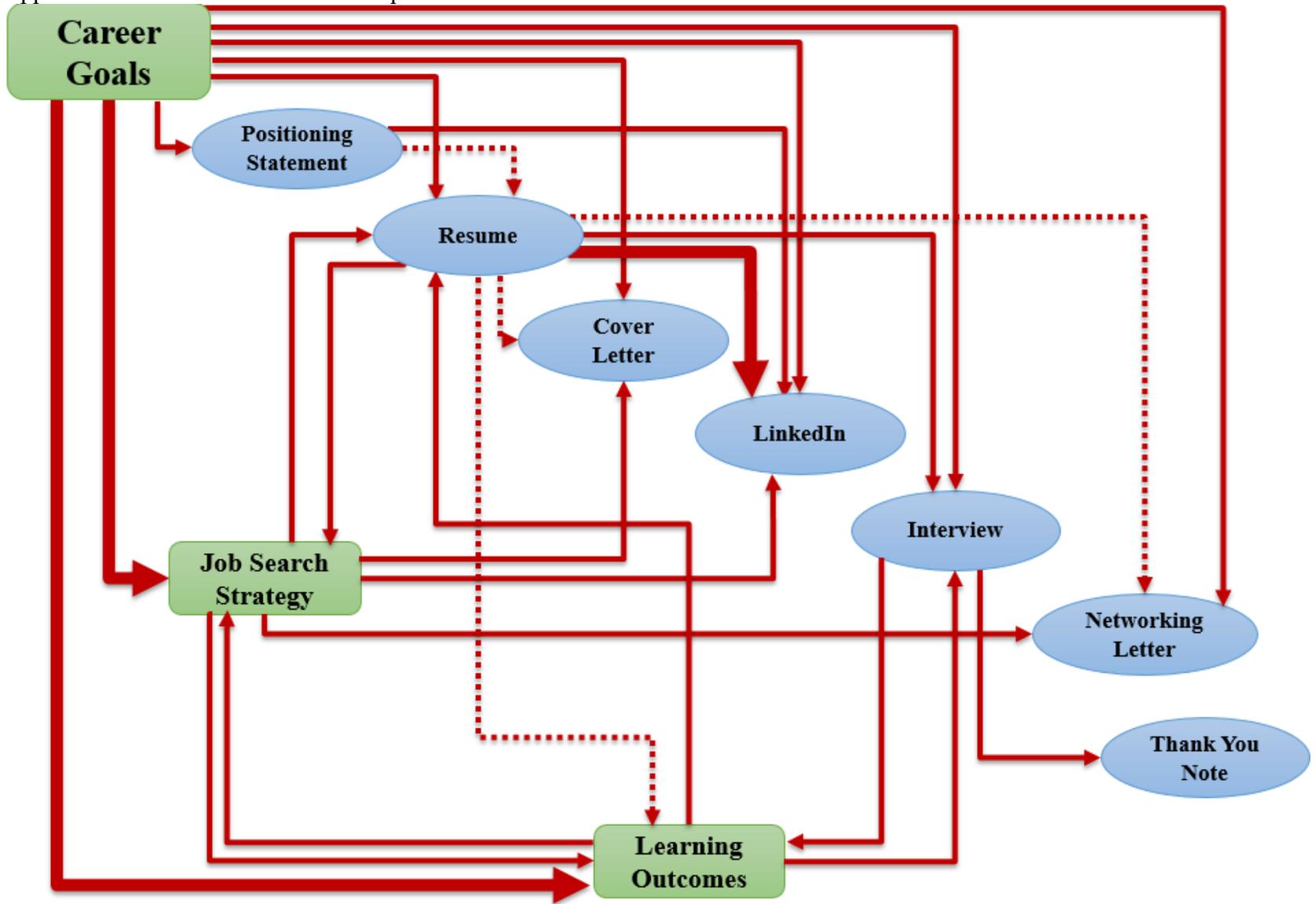


Once you have built your first experience, then it is time to begin again, but with bigger and better plans for your next experience...

Lesson 13 and Beyond.....



Appendix C – Course Connections Map



Lesson: Planning for a Successful Co-opObjectives:

1. Develop a plan to take advantage of your co-op experience.
2. Write learning outcomes for your co-op experience.
3. Assess your progress towards achieving your learning objectives.

Study Assignment:

1. Read: Kolb, David A. and Yeganeh, Bauback, *Deliberate Experiential Learning*. Article is posted on Blackboard.
2. Read and study the following pages about Learning Outcomes.
3. Read and study the procedures for accepting a Co-op job (handed out Lesson 1 and posted on Blackboard).
4. Prior to class complete Blackboard Quiz 6 on Learning Objectives and Deliberate Experiential Learning (LO/DEL Quiz 6).

Homework Assignment:

1. Complete Mindful Quiz 7.
2. Complete Critical Assignment 2: Learning Outcomes (see assignment on the following pages).

Study Notes:**What are student learning outcomes?**

- Learning outcomes are statements that specify what you will know, be able to do, or be able to demonstrate at the end of a specific time period (in this case your co-op job!).
- In terms of learning outcomes for your co-op experience, the outcomes should be expressed as the knowledge, skills, or abilities you would like to obtain by the end of your placement.
- Well written learning outcomes are **observable**, **measurable**, and **focus on you** rather than your supervisor or job environment.
- Your learning outcomes are a way for you to invite your co-op supervisor to support your learning in addition to managing your performance.

The learning outcomes are tied to the **knowledge and skills** that you hope to learn as a result of being on co-op. They should not be fuzzy ideas or things that you could learn or do though something other than the co-op experience. These are the things you will learn as a result of the co-op experience. Think about answering the question during an interview for a full time job you may get: **What did you learn on co-op?** You want to make the answer specific and non-trivial. These are things that will set you apart because you had the co-op experience. If you say “I learned how to apply the theoretical things I learned in class in a practical way”. You have said nothing and they will think you have learned nothing. If you say “I learned a growth mindset”, they will wonder why you had to go on co-op to learn that. While professional

Lesson: Planning for a Successful Co-op

behavior and ethics are important those are expected of all employees, saying you learned them on co-op is not a selling point; it is not a reason to hire you if you don't have them! Think about your answers to that question and you should be able to go back and write the objectives on what you will learn, based on what you anticipate saying when asked: what did you learn on co-op?

Remember they need to be measurable. You should be able to ask, as a result of co-op can I (your objective), and then point to and explain how you know that you can. Once you have achieved them they might become bullet points on your resume or LinkedIn profile because they will be measurable, tangible achievements. There are several levels of achievement of objectives. At one end is having knowledge, application requires a deeper level of achievement, and being able to synthesize things requires an even higher level. Not all learning outcomes require the same level of achievement.

Each lesson in the course study guide has a series of learning objectives/outcomes for the course. Look them over as examples of outcomes written various levels which can be used as a guide as you write yours. Remember learning outcomes (or objectives) are goals that describe what the student (you) learned and will be able to do as a result of a learning experience, in this case focused on your future co-op experience. Here are some hints as you write them:

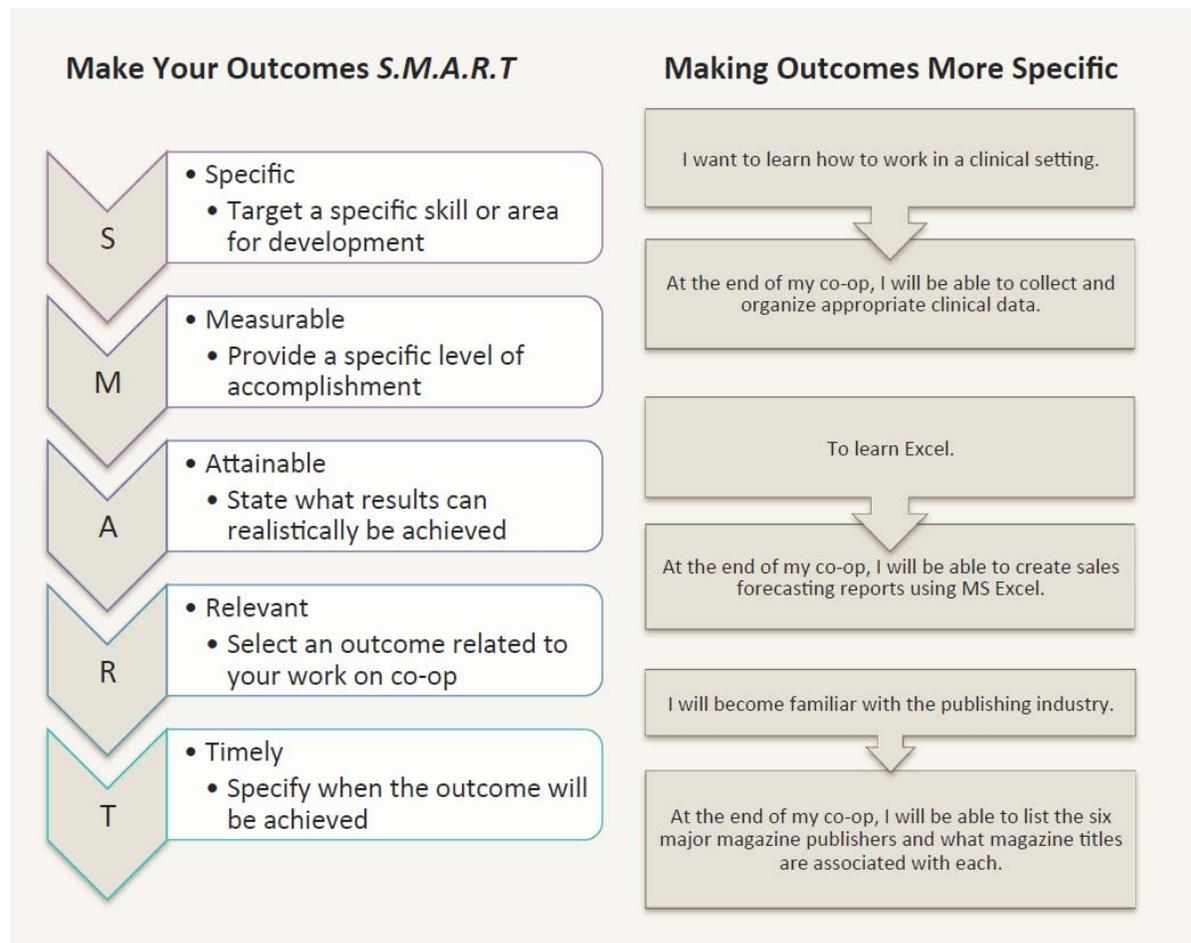
How do you write learning outcomes?

- Each outcome should begin with you as the subject.
 - Start with “As a result of co-op, I will be able to”
- Select a specific action verb that captures how you will demonstrate your learning. A good learning outcome includes an action verb. The verbs should be *measurable, tangible and concrete* (**“know”, “learn”, “understand”, “appreciate”, “become familiar with”, “become aware of”, “familiarize”, “study”, “become acquainted with”, “gain knowledge of”, “be introduced to”, “interact with”, and “realize” are examples that are vague and not measurable verbs—do not use them!**). Create, design, explain, justify, critique, diagram, draw, and produce are examples of measurable action verbs. You either can, or cannot create, explain, justify, draw, etc.
 - As an example if your objective was to “know about supply chain” (**NOT A GOOD OBJECTIVE**), you might say “yes I know about supply chain”, but what does that mean? Is your definition of “know” the same as the person asking the question? How would you demonstrate that you “know” it, and to the same level they expect. A better objective would be “describe the supply chain for a medical device company”. Then you can answer yes and go on to describe it and everyone will know you that you did learn about the supply chain for a medical device company. A higher level would be design a supply chain system, and even higher level would be critique and select the best supply chain process from competing proposals.
 - Better example: At the end of this co-op, I will be able to *write* learning objectives.
 - See the Bloom’s Taxonomy Verb List (following pages) for a list of example measurable verbs, all at different levels of achievement.

Lesson: Planning for a Successful Co-op

- You may include the level of accomplishment you hope to achieve in this area, if it adds to the clarity of the outcome.
 - At the end of co-op I will be able to write learning outcomes effectively.
- Focus on what you will learn and take away from the co-op experience, not what you will do. “I will meet 50 people in various fields in the company” is not about learning. “I will be able to explain the fundamentals of HR, finance, and ordering functions in a small parts supply company” is about learning and could be the result of meeting and talking with those 50 people.
- Use complete simple sentences.
- If it is well written it could be a “test” question as written. In the case of co-op you should think of it as asking to perform the objective; i.e. Design a structure, explain supply chain processes, create a business analysis report, etc.
- Do not make them trivial—explaining professional behavior, applying appropriate cultural sensitivity, selecting courses for the rest of my degree, expressing myself better—are things that are expected, you should not need to have a co-op to learn them nor should they be a major focus of your learning experience.
- With each outcome, provide a brief (2-3 sentences) explanation of why you selected this outcome and further explaining its importance to you and what it means.
- Number your outcomes, possibly make the outcome **bold**, so both you and we can easily see what the outcome is!

Lesson: Planning for a Successful Co-op



EXAMPLES OF CO-OP LEARNING OUTCOMES:

- I will be able to program applications using JAVA for commercial websites.
- I will be able to explain the Software Development Life Cycle.
- I will be able to create a schedule for a project using Microsoft Project.
- I will be able to critique new project proposals using the ABC standard.
- I will be able to write a product specification for an outside supplier.
- I will be able to design a bridge decking system to include preparation of all contact, bidding, and construction documents.
- I will be able to conduct an effective interview.
- I will be able to review and negotiate contracts and agreements for goods and services.
- I will be able to identify and pursue leverage opportunities with suppliers.
- I will be able to report my progress at weekly team meetings.
- I will be able to work effectively with third parties (Engineers, System Architects, Infrastructure Vendors, Customers and Developers) to achieve resolution on service-affecting issues.

Lesson: Planning for a Successful Co-op

**Bloom's Taxonomy Verb List
Cognitive ("thinking") Domain**

The columns represent levels of response/achievement/attainment (lower → higher)

Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Cite	Add	Acquire	Analyze	Abstract	Appraise
Define	Approximate	Adapt	Audit	Animate	Assess
Describe	Articulate	Allocate	Blueprint	Arrange	Compare
Draw	Associate	Alphabetize	Breadboard	Assemble	Conclude
Enumerate	Characterize	Apply	Break down	Budget	Contrast
Identify	Clarify	Ascertain	Characterize	Categorize	Counsel
Index	Classify	Assign	Classify	Code	Criticize
Indicate	Compare	Attain	Compare	Combine	Critique
Label	Compute	Avoid	Confirm	Compile	Defend
List	Contrast	Back up	Contrast	Compose	Determine
Match	Convert	Calculate	Correlate	Construct	Discriminate
Meet	Defend	Capture	Detect	Cope	Estimate
Name	Describe	Change	Diagnose	Correspond	Evaluate
Outline	Detail	Classify	Diagram	Create	Explain
Point	Differentiate	Complete	Differentiate	cultivate	Grade
Quote	Discuss	Compute	Discriminate	Debug	Hire
Read	Distinguish	Construct	Dissect	Depict	Interpret
Recall	Elaborate	Customize	Distinguish	Design	Judge
Recite	Estimate	Demonstrate	Document	Develop	Justify
Recognize	Example	Depreciate	Ensure	Devise	Measure
Record	Explain	Derive	Examine	Dictate	Predict
Repeat	Express	Determine	Explain	Enhance	Prescribe
Reproduce	Extend	Diminish	Explore	Explain	Rank
Review	Extrapolate	Discover	Figure out	Facilitate	Rate
Select	Factor	Draw	File	Format	Recommend
State	Generalize	Employ	Group	Formulate	Release
Study	Give	Examine	Identify	Generalize	Select
Tabulate	Infer	Exercise	Illustrate	Generate	Summarize
Trace	Interact	Explore	Infer	Handle	Support
Write	Interpolate	Expose	Interrupt	Import	Test
	Interpret	Express	Inventory	Improve	Validate
	Observe	Factor	Investigate	Incorporate	Verify
	Paraphrase	Figure	Layout	Integrate	
	Picture graphically	Graph	Manage	Interface	
	Predict	Handle	Maximize	Join	
	Review	Illustrate	Minimize	Lecture	
	Rewrite	Interconvert	Optimize	Model	
	Subtract	Investigate	Order	Modify	
	Summarize	Manipulate	Outline	Network	
	Translate	Modify	Point out	Organize	
	Visualize	Operate	Prioritize	Outline	
		Personalize	Proofread	Overhaul	
		Plot	Query	Plan	
		Practice	Relate	Portray	
		Predict	Select	Prepare	
		Prepare	Separate	Prescribe	

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Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
		Price	Size p	Produce	
		Process	Subdivide	Program	
		Produce	Train	Rearrange	
		Project	Transform	Reconstruct	
		Provide		Relate	
		Relate		Reorganize	
		Round off		Revise	
		Sequence		Rewrite	
		Show		Specify	
		Simulate		Summarize	
		Sketch		Write	
		Solve			
		Subscribe			
		Tabulate			
		Transcribe			
		Translate			
		Use			

Lesson: Planning for a Successful Co-op**Critical Assignment 2 – Learning Outcomes****Due prior to the start of Lesson 12
125 points**

Write your five learning outcomes for your co-op experience. **Learning Outcomes** are goals that describe how a student will be different because of a **learning** experience. More specifically, **learning outcomes** are the knowledge and skills you will take with you from a co-op **learning** experience. This will require you to think and do some self-assessment and reflection. If you have a co-op position lined up they may be very specific and should be tailored to that job; if not tailor them to the type of co-op job you are searching for. Learning Outcomes should be *measurable, tangible, and concrete*; they should each start with “I will be able to...”

With each outcome provide a brief explanation (two to three sentences) of why you selected this particular outcome.

When selecting your five outcomes, you should think about your career goals, what you already know, what you think you know, what you need to know, what you want to know as guides to what is significant for you. You are only picking five so make sure they are substantial and valuable to your career progress.

This exercise is something that will help you maximize and take control of your co-op experience. You are much more likely to achieve these outcomes and learn from your experience if you plan for it.

Submit your assignment through Blackboard. Ensure the top line has the following:

ENCP 6000, Section ## Critical Assignment 2: Learning Outcomes *Last Name, First Name*

NOTE: If you need to redo this assignment you will be required to turn it in during Exam week!

Include this in your e-portfolio as well!

Notes on Learning Outcomes Assignment:**What are student learning outcomes?**

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1. Ambrose, S., C. Talgar, and S. Chang, *Evolving the Co-op Curriculum*. 2013, Northeastern University: Boston, MA.
2. Kolb, D.A., *Experiential learning : experience as the source of learning and development*. 1984, Englewood Cliffs, NJ: Prentice-Hall. 256.
3. Argyris, C. and D.A. Schön, *Organizational learning : a theory of action perspective*. 1978, Reading, Mass: Addison-Wesley Pub. Co. 339.
4. Greenaway, R., *Dynamic Debriefing*, in *The Handbook of Expeirntial Learning*, M. Silberman, Editor. 2007, Pfeiffer: San Francisco, CA. p. 59-80.
5. Ambrose, S., *Experiential Learning at Northeastern University*. 2013, Northeastern University: Boston, MA. p. 4.
6. Allum, J., *Graduate Enrollment and Degrees: 2003 to 2013*. 2014, Council of Graduate Schools: Washington, DC.
7. LiveCareer.com. *Top 10 Soft Skills in Demand*. [cited 2014; Available from: <https://www.livecareer.com/career-tips/career-advice/soft-skills-in-demand>].
8. Harrington, P., *Human Capital and the New American Labor Market*. 2016, Cooperative Education & Internship Association 2016 Annual Conference.
9. Casserly, M., *The 10 Skills That Will Get You Hired In 2013*, in *Forbes/Entrepreneurs*. 2012, Forbes.com LLC: Jersey City, NJ.
10. Dweck, C.S., *Is Math a Gift? Beliefs That Put Females at Risk*, in *Why aren't more women in science? Top researchers debate the evidence.*, S.J. Ceci and W. Williams, Editors. 2006, American Psychological Association: Washington, DC.
11. Dweck, C.S., *Mindset*. 2008, New York, NY: Ballantine Books.
12. Cimpian, A., et al., *Subtle Linguistic Cues Affect Children's Motivation*. *Psychological Science*, 2007. **18**(4): p. 314-316.
13. Langer, E.J., *The Power of Mindful Learning*. 1997, Cambridge, MA: Dacapo Press.
14. Mazar, N., O. Amir, and D. Ariely, *The Dishonesty of Honest People: A Theory of Self-Concept Maintenance*. *J. Mark. Res.*, 2008. **45**(6): p. 633-644.
15. NSPE, *NSPE Code of Ethics for Engineers*. 2007, National Society of Professional Engineers.

16. Ryan, R.M. and E.L. Deci, *Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions*. Contemporary Educational Psychology, 2000. **25**: p. 54-67.
17. Pink, D.H., *The puzzle of motivation*, in *Ted Talks*. 2009.
18. Pink, D.H., *Drive: The Surprising Truth About What Motivates Us*. 2009, New York, NY: Riverhead Books.
19. Dewey, J., *Democracy and education : an introduction to the philosophy of education*. 1st Free Press paperback ed. ed. 1966, New York The Free Press.