WIP: Professional development experiences from participation in an engineering cooperative education program

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WIP: Navigating Career Development: Engineering Students' Co-op Experiences Through the Lens of Social Cognitive Career Theory

Introduction

Co-op placements allow students to apply academic knowledge in real-world settings, collaborate with professionals, and develop a variety of skills essential for future careers, connecting classroom learning with professional work. These experiences can have formative, transformative, or empowering effects on students' preliminary career goals (Zarandi & Reeping, 2024). Lent (2002) argued that as individuals gain confidence in an activity, such as professional work, they expect favorable outcomes and create goals to sustain or enhance their participation in such an activity. Additionally, Reisberg et al. (2012) found that cooperative experiences, especially those involving teamwork and knowledge application, significantly enhanced work self-efficacy, promoted greater independence and reduced "reality shock" (p. 14) as students transition into the workforce. Further, co-op experiences allowed students to explore various occupational categories, and a significant percentage of graduates took jobs in the same field they explored during co-op, particularly in management, education, and architecture/engineering (Linn, Ferguson, & Egart, 2004). While studies explore co-op and work placement using Social Cognitive Career Theory (SCCT) (Reisberg et al., 2012; Raelin et al., 2013; Raelin et al., 2014; Chukwuedo & Ementa, 2022), they tend to focus on the self-efficacy component of the theory, such as linking co-op participation to self-efficacy growth (Reisberg et al., 2012) and retention (Raelin et al., 2013; Raelin et al., 2014). However, through utilizing SCCT as a framework, it has been found that work placement learning can increase graduate employability and higher education quality (Chukwuedo & Ementa, 2022). There is a need to explore students' professional development on co-op further utilizing all three main components of SCCT; self-efficacy beliefs, outcome expectations, and personal goals (Lent, 2002) to fully understand students' experiences. This study aims to examine how engineering students describe their professional development during co-op experiences through the lens of Social Cognitive Career Theory (SCCT), focusing on self-efficacy beliefs, outcome expectations, and personal goals as key constructs shaping their reflections. By investigating these elements, the study seeks to gain insights into how co-op experiences impact students' confidence in their abilities, their career expectations, and the personal goals they establish and accomplish during these practical work experiences. The primary research question was: *"How do engineering students participating in a co-op program navigate their career interests, decisions, and outcomes through the constructs of Social Cognitive Career Theory?"*

Theoretical Framework

Many studies explore co-op and work placement learning using Social Cognitive Career Theory (SCCT) (Reisberg et al., 2012; Raelin et al., 2013; Raelin et al., 2014; Chukwuedo & Ementa, 2022). SCCT seeks to explain three aspects of career development: how people develop academic and career interests, make educational and career choices, and obtain academic and career success. SCCT includes three core components: self-efficacy beliefs, outcome expectations, and personal goals (Lent, 2002).

Self-efficacy is defined as an individual's belief in their ability to perform behaviors that are necessary to achieve specific performance outcomes (Bandura, 1986). Self-efficacy can change over time and be influenced by a person's experiences. People with high self-efficacy will approach difficult tasks as challenges they seek to master rather than threats to avoid. Therefore,

those with high self-efficacy who encounter professional challenges are likely to overcome them and persist in the face of failure. The most effective way to create a strong sense of self-efficacy is through mastery of experiences; therefore, those with high self-efficacy have developed and recognized their strengths and are convinced they have what it takes to succeed. High self-efficacy will lead people to try harder to succeed, which promotes the development of their skills and leads them to address areas of growth (Bandura, 1994).

Richardson and Watt (2018) propose that career goals and professional identity are dynamic, evolving across one's lifespan, and shaped by personal and social factors. According to Beard et al. (2001), co-op programs provide students with valuable professional and personal growth opportunities. This placement enabled students to apply their academic knowledge in real-world settings, fostering independence and adaptability. Such placements contributed to students' personal growth through enhanced communication and problem-solving skills while gaining significant work experience relevant to their fields. Professionally, students could apply their technical expertise in practical work environments, which supported their overall development and prepared them for future career challenges.

Self-efficacy influences other components of SCCT and performance attainment, whereas outcome expectations only influence personal goals, which then influences performance attainment, as shown in Figure 1. These elements, such as career goals, evolve across one's lifespan and are shaped by personal and social factors (Richardson & Watt, 2018). As one's self-efficacy changes, one's outcome expectations and goals will also change, affecting performance. Additionally, outcome expectations may change independently of self-efficacy, changing one's goals and affecting performance. The process repeats in a cycle in which one's performance attainment will become a past experience, impacting self-efficacy and outcome expectations, which then impacts future performance (Lent, 2002).
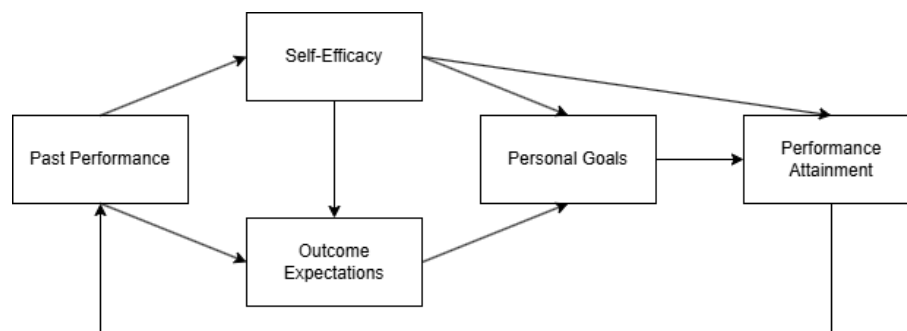

Figure 1: Adapted subset of SCCT performance model from Lent (2002).

Research Design
This study adopts a phenomenological research design to explore engineering students' professional development during co-op experiences, focusing on how they perceive and reflect on their learning and career growth. Phenomenology, which emphasizes the lived experiences of individuals (Moustakas, 1994), aligns with the objective of capturing students' subjective interpretations of their co-op experiences. This methodology allows for an in-depth exploration of

how participants make sense of their professional journeys, highlighting the personal and contextual factors that shape their development.

We used existing student survey data collected during their co-op experiences in 2023-2024 at a large Midwest public university (n = 5003). The College of Cooperative Education and Professional Studies administered the survey to students at the beginning, middle, and end of their co-op experiences. Students were asked questions designed to elicit detailed reflections on their ability to navigate workplace challenges, their communication and problem-solving skills, their perceptions of personal strengths and areas for growth, and the ways in which the co-op experience influenced their professional identity and career goals. The questions include:

Self-Efficacy Beliefs: This question assesses students' confidence in their ability to handle tasks and overcome challenges in the workplace. Asking students to reflect on challenges and even failures encourages them to face challenges head-on, reinforcing their belief in their ability to overcome these challenges and failures and strengthening their self-efficacy (Bandura, 1994). The question in this category is:

> Give an example of a challenge or failure that you faced during this experience. How did you navigate the situation, and what did you learn that you can apply to future situations?

Outcome Expectation and Personal Goals: This question assesses students' ability to establish, pursue, and evaluate their personal objectives throughout the co-op experience. They concentrate on goal setting, progress, and challenges. When people set goals, they organize and guide their actions even when setbacks are experienced (Lent, 2002). In setting goals for the co-op, students guide their behavior even without manager guidance or positive feedback while sustaining progress and professional development. Moreover, people are more likely to engage in activities where they expect a positive outcome and where their involvement will be valued (Lent, 2002). When students articulate their outcome expectations, a deeper understanding of the impact of their co-op experiences on future expectations can be gained. The question is:

> Write a goal to help you develop the professional skill selected above.

A thematic analysis was applied to these responses. This approach allows for the exploration of recurring themes related to students' experiences, perspectives, and reflections on their co-op placements and provides insights into how students' co-op experiences contribute to their self-efficacy, influence their career aspirations, and shape their professional and personal development goals, all within the framework of SCCT. Major themes were initially extracted from the first thousand responses, and analysis continued until thematic saturation was reached, defined as the point when no new information emerged and further coding was no longer needed (Guest et al., 2006). This study follows the model of inductive thematic saturation, where data analysis proceeded iteratively until no novel themes were identified, acknowledging the variability in saturation as described by Saunders et al. (2018).

Results and Discussion

Our findings illustrate how engineering students' co-op experiences contribute to their professional development through the lens of Social Cognitive Career Theory (SCCT). Our thematic analysis of selected items revealed that co-op placements fostered significant growth in students' confidence, shaped their career aspirations, and reinforced their goal-setting abilities. These experiences were interpreted through SCCT constructs, demonstrating how self-efficacy

was enhanced by overcoming challenges, outcome expectations were influenced by real-world exposure, and personal goals were refined through proactive skill development.

Self-Efficacy and Professional Growth: Our thematic analysis of responses to the selected survey question highlights how students developed self-efficacy through their co-op experiences. This question evaluated students' confidence in overcoming obstacles and their ability to reflect on challenges to build resilience and problem-solving skills. Key themes extracted from the responses are presented in Table 1, with relevant codes available in Appendix I:

Table 1. Themes relevant to self-efficacy

Theme	Description
Problem-Solving	Students enhanced their self-efficacy by tackling technical and logistical challenges, applying logical reasoning, and finding creative solutions. Successfully overcoming these problems reinforced their confidence in handling future workplace difficulties.
Communication and Collaboration	Facing communication barriers strengthened students' belief in their ability to coordinate with diverse teams and resolve conflicts effectively. This growth in interpersonal skills contributed to their overall confidence in navigating professional environments.
Taking Initiative and Leadership	Many students built self-efficacy by stepping into leadership roles, taking ownership of projects, and addressing challenges proactively. These experiences validated their ability to lead and make impactful decisions under pressure.
Technical Skill Development	Mastering new tools, software, and technologies allowed students to build confidence in their technical abilities. Overcoming challenges in this area demonstrated their capacity to adapt to and excel in evolving professional demands.

These themes illustrate how co-op experiences immersed students in authentic work environments, exposing them to challenges not typically encountered in formal educational settings. Students' reflections demonstrated how these real-world experiences impacted their confidence, resilience, and problem-solving abilities. Bandura (1986) defines self-efficacy as an individual's belief in their capacity to execute tasks and achieve goals. Navigating challenges and reflecting on their experiences helped students strengthen their self-efficacy through mastery experiences and vicarious learning. Overcoming obstacles reinforced their confidence in tackling future problems, aligning with SCCT's assertion that self-efficacy is bolstered by successfully managing difficult tasks (Lent, 2002). Mastery of experiences remains the most effective means of strengthening self-efficacy (Bandura, 1994).

Students recounted overcoming technical difficulties, communication barriers, and leadership challenges by applying problem-solving techniques, seeking mentorship, and taking initiative. These experiences enhanced their resilience and adaptability, key traits that contribute to higher levels of self-efficacy (Bandura, 1986). For instance, students who navigated project-related setbacks emphasized their ability to persist and troubleshoot until solutions were identified. This confidence aligns with Lent's (2002) assertion that increased self-efficacy promotes favorable outcome expectations and motivates individuals to sustain professional engagement. Furthermore, leadership, adaptability, and communication emerged as recurring elements, demonstrating that self-efficacy extends beyond technical skills to include interpersonal and organizational capabilities. This holistic development prepares students for future workplace

challenges, promoting confidence in both individual and collaborative contexts. Overcoming setbacks reinforced the notion that challenges are opportunities for growth, further strengthening students' abilities to handle adversity. These findings highlight SCCT's cyclical nature, where positive workplace experiences bolster self-efficacy and drive students to pursue more ambitious goals.

Outcome Expectations and Goal Setting: At the start of their co-op experiences, students identified key skills to develop, such as communication, leadership, and teamwork. They were tasked with setting and pursuing personal goals, focusing on tracking progress and overcoming challenges. This process aligns with the personal goals component of SCCT, which emphasizes goal setting as a means to organize and direct actions, even when setbacks occur (Lent, 2002). Students' abilities to set objectives, seek feedback, and adjust strategies highlight the proactive role of goal setting in fostering their professional development.

The thematic analysis of some of students' goal-setting and reflective responses revealed key themes associated with each skill (Appendix II):

1. Communication: Students described actively participating in discussions, seeking supervisor feedback, and applying it to improve their communication skills. They highlighted practices such as active listening, refining verbal and written communication, and tailoring messages to fit different professional contexts. These efforts were consistently aimed at building confidence and achieving better workplace collaboration.

2. Critical Thinking: Students emphasized analyzing complex problems, identifying solutions, and breaking down tasks into smaller, manageable parts as key strategies for developing critical thinking. By stepping out of their comfort zones and tackling unfamiliar challenges, they built confidence in their abilities to think critically and adapt to evolving situations, aligning with SCCT's focus on achieving defined outcomes through persistent effort.

3. Teamwork/Collaboration: Responses highlighted goals centered on improving collaboration with diverse teams. Students mentioned working on cross-functional projects, building stronger relationships, and improving communication within teams. These goals reflected their focus on fostering adaptability, mutual respect, and conflict resolution, which are crucial for contributing to team success and achieving professional outcomes.

By aligning their goals with their desired skills, students demonstrated sustained effort and intentional practice, reinforcing their self-efficacy and contributing to their evolving professional identity. This motivation drove them to persist in their objectives, even when faced with challenges, illustrating SCCT's assertion that personal goals act as a bridge between self-efficacy and performance outcomes. Furthermore, the varied and intentional goals across different skills reflect students' commitment to addressing personal and professional growth areas, contributing to their evolving professional identities.

The consistent focus on communication skills across various engineering disciplines highlights the essential role of interpersonal abilities in workplace success (Darling & Dannels, 2003). Students who actively sought feedback and applied it to their practice demonstrated a higher likelihood of

achieving their goals, underscoring the interplay between goal setting and performance improvement (Asmus, 2015). Moreover, students' ability to meet their personal goals reinforced SCCT's assertion that goal setting serves as a critical intermediary between self-efficacy and performance outcomes. (Lent, 2002).

Implications

The results of this study suggest several implications for co-op program design and implementation. First, fostering environments that challenge students while providing access to mentorship and collaborative opportunities can significantly enhance self-efficacy and career readiness. Given that reflection is a defining element of co-op programs, institutions should emphasize and embed structured goal-setting and reflective practices into co-op curricula, encouraging students to actively analyze and learn from their experiences to promote continuous professional development.

Additionally, the transformative impact of co-op experiences on career clarity highlights the value of exposing students to diverse roles and industries. Facilitating cross-departmental projects and rotational placements can broaden students' understanding of potential career paths and enhance their adaptability in the workforce.

Next Steps

We will continue analyzing the rest of the chosen skills that students hope to develop in their co-ops to better understand students' goal-setting and outcome expectations through the perspective of SCCT.

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Appendix I: Self-Efficacy

Theme	Description	Supporting Quotations
Problem-Solving	Many students mentioned that they are more comfortable dealing with uncertain situations or work as long as they have been through similar situations gained from the co-op experiences. Some students addressed the challenges they faced by being resourceful, seeking external guidance, and independently troubleshooting technical or project-related issues.	For instance, one student mentioned: "*During a critical SCADA integration project, I encountered a complex technical problem… My attempt to solve the issue took longer than anticipated… reached out to more experienced colleagues and mentors.. I documented the issue, the steps taken to diagnose and fix it, and the lessons learned. This documentation served as a valuable reference for future projects ..*"
Communication and Collaboration	Students mentioned that they often overcame difficulties by clarifying misunderstandings, holding meetings, and engaging with team members or supervisors to resolve issues.	"*One of the biggest challenges that I had this semester was communicating/collaborating with a particularly difficult person to work with… While I did not have much 1:1 time with this person, I definitely was able to refine my patience and understand that sometimes, there is a need to be a little more forthcoming with expectations/information for some than others... along with clear communication of expectations when working on projects that have safety factors involved.*"
Taking Initiative and Leadership	Many students shared that they took on leadership roles when unexpected challenges emerged, showing initiative by handling tasks on their own or directing their teams through crucial project stages.	"*A challenge I faced… when my manager went on Paternity leave. This gave me the opportunity to take a leadership position. In order to manage efficiently I kept a list of tracking items and update said list accordingly based on the work that was either completed or had complications…*"
Technical Skill Development	The final major challenge students highlighted was learning new tools, software, or technical skills. They overcame these difficulties by attending	"*An example of a challenge I faced was through the learning of Microstation/Open Roads… It took me forever to figure out the simplest of tasks… To face this challenge I*

	training sessions, practicing on their own, and seeking support from mentors.	*approach my supervisor, Andrea, and asked if she had some good training sources…"*

Appendix II: Personal Goals

Communication		
Theme	**Description**	**Supporting Quotations**
Active Engagement and Feedback	Actively participating in the work environment, seeking regular feedback from supervisors, and applying suggestions to improve communication	*"My goal is to enhance my communication skills…To achieve this, I will actively listen and take detailed notes during team meetings, seek regular feedback from my supervisor, and implement suggestions to improve…"*
Improvement in Communication Channels (Verbal, Written, and Non-Verbal	Students worked on enhancing verbal and written communication, improving report writing, and practicing active listening	*"Work on verbal and written communication skills. As well as active listening skills."*
Confidence Building and Presentations	Focused on strengthening public speaking skills and seeking opportunities to present and receive feedback, boosting confidence in interdepartmental interactions	*"I want to seek out presentation and demonstration opportunities to further expand on my level of confidence with speaking…"*
Adapting Communication to Different Work Contexts	Tailoring communication styles to different mediums and audiences, such as using email, phone, or chat effectively	*"We worked towards understanding different communication styles by understanding different personality/behavior assessments…"*
Critical Thinking		
Problem Solving and Solution Development"	Students emphasizing the importance of analyzing situations and applying logical approaches to tackle real-world challenges	*"… understand how to overcome obstacles as they occur. Working with a long term project from start to finish will allow me to understand the entire engineering process as well as how to develop innovative solutions…"*
Project Management and Strategic Planning	Students' efforts to enhance critical thinking by breaking	*"During my previous two co-ops I focused on my*

	down large tasks into smaller, more manageable steps and creating structured plans to improve execution	*skills that are applicable to personal and emotional growth. For this rotation I want to instead focus on my ability to tackle large problems and projects. A goal for me would be to work on a project for an extended period by tackling small problems and proceeding to the next steps myself (with some direction of course) but without being told how."*
Working Outside of Comfort Zones	Students' desire to take on unfamiliar tasks and responsibilities to strengthen their critical thinking abilities.	*"I will develop my critical thinking skills by taking every opportunity possible during this semester to push myself to do something difficult…"*
Teamwork/Collaboration in Diverse Settings		
Collaborating Across Functions and Teams	Students emphasizing the value of working with diverse peers and cross-departmental projects.	*"To enhance my teamwork…by actively participating in at least one cross-functional team projects… focusing on effective communication, respect for diverse perspectives, and conflict resolution…"*
Communication and Relationship-Building	Strengthen connections with teammates and actively engage with colleagues to improve overall collaboration	*"Continue to develop my relationship building skills by attending more on-site visits, conducting internal and external trainings, and working with new employees…"*

Team Player Mindset	Completing tasks on time, staying adaptable, and responding to team needs	*"... I want to learn how to collaborate with my teammates more effectively, especially those that I work with that are in different countries... I'm learning how to collaborate with them when I have deadlines to meet...it is crucial to communicate with them effectively."*