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Role of Cooperative Programs in the University-to-Career Transition: A Case Study in Construction Management Engineering Education*

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With the recent economic and technological rapid change, a major shift in the workforce nature is expected shortly. Construction management is currently focused on increasing productivity and optimizing structures costs. However, new management strategies rely on quality management, global manufacturing, building information modeling, and many others. Those new strategies require managers with soft skills and can operate in situations. With that in mind, cooperative education (Co-op) has a pivotal role in formulating the relationship between the universities and industry for better reflecting on the recently needed industrial requirements in curriculum content. In this paper, the role of the Co-op programs in university-to-career transition has been explored through a case study of the engineering management students of Prince Sultan University (Riyadh, KSA). Direct and Indirect assessment studies were performed to investigate the nature of the Co-op programs offered to the five student batches (2015–2019) of the Construction Management program (CMP), the students' gained experiences upon completion of the Co-op, the program's overall quality and efficiency, and the Co-op students' readiness to start their career. The 5A's indicators model has been used for the indirect assessment, while the SEF direct assessment tool was proposed to evaluate the student learning outcomes achieved by the end of the program, considering the evaluation of Employers, Faculty, and the students' self-assessment. The assessment results showed that the real-life experiences gained by Co-op students improved their job readiness. It also increased their chances of getting a job even before graduation. The study found that 70% of PSU construction management Co-op students got jobs through the Co-op. Nevertheless, the study also addressed several weak points associated with the offered Co-op, such as the unreliability of the employers' evaluation and ignoring the student self-assessment in the currently utilized direct assessment method.

Keywords: real-life experience; cooperative program; university-to-career transition; engineering higher education; assessment; case study

1. Introduction

Career-related work experience is the main transition goal aspired by students of engineering higher education at the end of their undergraduate programs. Such valuable experience is also vital for formatting the engineering student's identity [1]. Therefore, engineering programs are fundamentally designed to meet this goal. Most engineering institutions usually rely on three standard models in building the student's career-related work experience. Those three models could be classified as; the full-time Co-op program, the internship program (part-time), and the senior graduation project program.

The full-time cooperative educational programs (co-op) are designed to offer students the chance of payment academic credit for a real-life job experience during their undergraduate study. One of the significant differences between co-op programs and traditional internships (part-time programs) is that co-ops tend to be full-time positions over an entire semester(s). Students typically do not attend classes during the work portion of their co-op programs. In contrast, internships generally cover fewer hours and are usually considered part-time positions. On the other side, both laboratories and design projects offer hands-on opportunities to measure the student's accumulated engineering knowledge and experiences before graduation [2]. Two-semester senior project programs require the student to complete a graduation project simulating the after graduation practices under a board of professors and technical experts' supervision. At the same time, the project itself provides the student with some new skills and information and strengthens the acquired ones.

Primarily for engineering management programs, Co-op programs are offered more thoroughly by engineering colleges than internships. Engineering institutions usually support the Co-op experience, whether this takes the form of offering specific opportunities or contact industry advisors to provide more chances for their students. This may be attributed to the fact that the traditional senior projects lack the real-life work experi-

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ence represented in dealing with industrial clients, using the company's available resources, and solving different in-situ problems that might arise during the project implementation [3]. This may explain why students with high GPA usually tend to select the Co-op option before graduation [4].

In the same line, the integrated cooperative education is a fundamental strategy that fosters collaboration between academic institutions and businesses. With that in mind, it provides a strong recruitment chance, as the Co-op company often recruits students from the Co-op participants, as reported in many studies [4–6]. According to the college affordability guide 2021 [5], 56.8% of employers made full-time offers to their Co-op students. McGinn [6] highlighted that 85% of University of Limerick graduates obtain employment in industry and commerce through their Co-op. In the same line, Brahimi et al. [4] also concluded that students who choose cooperative education are more likely to be hired before graduation. Their recruitment rate was 78% higher than the students who did not choose the Co-op option. Even if the Co-op company does not hire the student, the gained practical work experience may make him more appealing to other employers tending to hire fresh graduates, who often have little relevant work experience aside from different training programs.

As a result, cooperative education is now established in an enormous number of universities; in 1996, there were more than 2,000 universities and colleges in the united states [6]. Most US engineering colleges that offer engineering management programs support the Co-op alternative: the University of Delaware Newark, University of Cincinnati, Drexel University, University of California at Berkeley, and many others are examples of the institutions that support the Co-op programs [7–10]. Despite that, there are significant differences in the curricula of the offered Co-op programs among those institutions in terms of the program period and credit hours, the assessment method, the expected learning outcomes, and the grading scheme or mark distribution. In addition, there is a considerable debate about the specific skills and knowledge that a qualified engineer should possess before starting his career and the characteristics of the assessment method that should be adopted to accurately reflect the student achievements at the end of the Co-op program [11]. With this diversity, it cannot be assumed that the results will always be equivalent or consistent among the different curricula.

Those differences are not only limited to the engineering institutions among themselves, but also there is an apparent inconsistency between the intended learning outcomes targeted by the industry, faculty, and the students themselves to create a qualified modern engineer in general. Wilson and Li [12], and Friel [13] reported that industry groups have specific needs regarding engineering learning outcomes that the graduate should have before joining the labor market. In this regard, Nguyen [14] surveyed academics, industry personnel, and students to investigate fresh graduates' aspired outcomes. This survey pinpointed that industry personnel considered attitude to be of most significance, while academics emphasized technical knowledge and skills, whereas the students overlapped with both academics and industry for both technical knowledge and skills and attitudes. However, all three groups agreed on several generic skills and attributes necessary for developing a modern engineer. These generic requirements should be given adequate coverage in engineering education.

Periodically, engineering programs' curricula are reviewed to satisfy the rapidly changing market needs and demand of the vast economic and political changes [15]. With the recent technological and economic transformation globally experienced nowadays, engineering institutions and the industry should be ready for the expected severe change in the workforce nature shortly. Also, with rising deregulation and free competition, the industry is driven by global competitiveness, consequently raising the aspired interdependence of the workforce's scientific, technological, and management competencies. The construction management's current focus is enhancing productivity and optimizing structures costs. However, new management strategies rely on graduates having solid skills and personal traits to operate in situations including total quality management, world-class manufacturing, learning organization, and teamwork [6]. As a result, this should lead to a formal partnership between education and industry to better reflect changing industrial requirements in curriculum content. STIAC [16] highlighted the potential importance of undergraduate cooperative education in formalizing university-industry partnerships.

With this diversity, it would not be possible to generalize a model for all engineering programs completely. Also, it is crucial to disaggregating majors in examining the effects of academic and career preparation interventions on student outcomes in engineering education [17]. Consequently, it might be fundamental to tailor the assessment methods and the evaluation indicators to the particular engineering discipline and the required knowledge, skills, and attributes to create a qualified engineer for a specific engineering field (e.g., engineering management). This assessment method

should be able to provide reliable answers for several fundamental questions during and after the student accomplishment of the Co-op program [18]. Those questions include; Do Co-op students become better problem solvers? Did they reflect on the utilized process through the Co-op process? Is engaging in the co-op process improved their self-directed learning, attitudes, and team working skills? Particularly for the last question, one of the most valuable skills the students should gain during the Co-op program is self-directed and lifelong learning skills. Especially those skills are essential in the University-to-Career Transition stage [19–22]. Those skills transfer the student from the entire dependence on the instructor/mentor in obtaining information to a broader horizon in obtaining any information required after graduation. Therefore, student self-assessment should be given a weight in the direct Co-op student assessment. However, most engineering management curricula only depend on the evaluation by the Co-op-organization, and the faculty, ignoring the students' self-assessment.

This paper explores the role of the Co-op programs in university-to-career transition through a case study of the engineering management students of prince sultan university. Direct and indirect assessment studies are performed to investigate the nature of the Co-op programs offered to the five student batches (2015–2019) of the Construction Management program (CMP), the students' gained experiences upon completion of this training program, the overall quality and efficiency of the program, and the readiness of the Co-op students to start their career. The 5A's indicators model is used for the indirect assessment, while the SEF direct assessment tool is proposed to evaluate the student learning outcomes achieved by the end of the Co-op program, considering the evaluation of Employers, Faculty, and the students (Self-Assessment). The primary purpose of this assessment is to explore the Co-op's efficiency in developing the real-life experience and job readiness needed for the senior students to be more appealing to the labor market concerning the new management strategies and their reflection on the students' intended skills learning outcomes. Also, to address the primary weakness of the Co-op program for further improvement.

2. Study Zone and Relevant Background

The Kingdom of Saudi Arabia is divided into (13) provinces. Riyadh (Ar Riyad) province is one of the largest regions in terms of area after Ash Sharqiyah, as shown in the Saudi Arabia map presented in Fig. 1. Riyadh city is located in the kingdom's central region, and its area is approximately 1600 square km. Riyadh city is Saudi Arabia's capital and central financial hub. Riyadh province contains three huge universities, King Saud, Imam Mohammad bin Saud Islamic, Princess Noura, in addition to the other educational facilities like military and security colleges, cultural information centers, stadiums, literary Centers, and public libraries. Also, it contains several private universities such as Al-Yamamah, Al-Faisal, Dar-Al-oloum, and Prince Sultan University (PSU).

Most of the universities in Riyadh city are located out of the center of the city. At the same time, PSU is situated in the center of Riyadh municipality, which gives it the privilege of being surrounded by plenty of companies that work in different engineering industries and many megaprojects that accept hosting Co-op students. Besides, most of the engineering institutions available in Riyadh are offering the traditional civil engineering program. With that in mind, PSU has a unique diversity of engineering management programs that attract both local and international students. Therefore, Prince Sultan University (PSU) has been chosen for this evaluation.

Recently, non-oil revenues are growing in the kingdom, as confirmed during Saudi Arabia's 2020 budget launch. Construction and industrial projects have become the key job creators in the country. The significance of construction in Saudi Arabia is underscored by its suite of gigaprojects; transport and mobility schemes such as Riyadh Metro, social infrastructure developments such as the Ministry of Housing's Sakani program; and energy megaprojects such as the state-owned Aramco's Berri and Marjan oil fields. These developments offer a glimpse into Saudi Arabia's focus on infrastructure-building, economic diversification, and raising the standard of living for its citizens and residents alike. According to Statista Research Department 2018 [23], the Saudi Arabia construction market is expected to grow with a percentage up to 6% by 2024 (Fig. 1b), compared to the industry value noted in 2019 for the construction sector, as shown in Fig. 1a.

In line with the Saudi Vision 2030 [24], Prince Sultan University aspires to provide a quality education equal to other reputable universities globally. Therefore, three engineering programs were established in the Engineering Management Department (EMD) of the College of Engineering at PSU, responding to the high demand in the construction industry of the Middle East for engineers equipped with managerial skills, techniques, and tools. Those programs are; the Construction management program (CMP), Production management program (PMP), and the recently added Civil

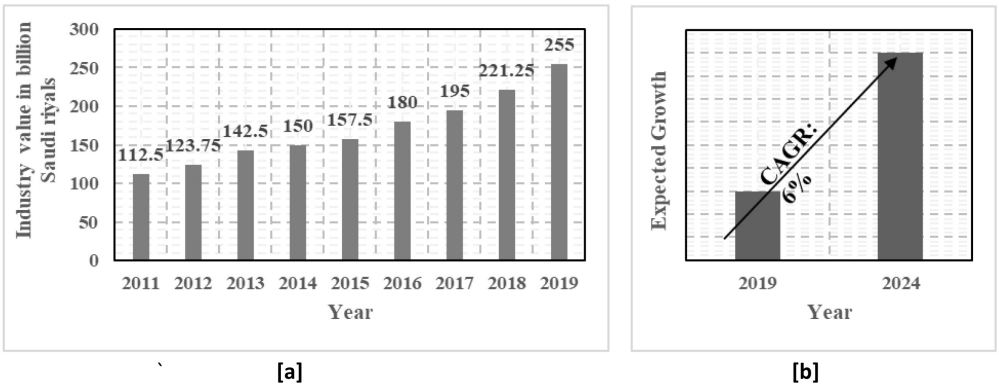


Fig. 1. Saudi Arabia's construction sector growth **[a]** Saudi Arabia construction market – growth, trends, and forecast (2011–2019). **[b]** Saudi Arabia production market – growth, trends, and forecast (2015–2019). **[c]** Expected growth rate (2024) [23].

and Environmental Engineering (CEE) program. The three programs offer two options for the students' career transition. The first is the full-time Co-op program, and the second is the traditional part-time internship alongside three additional elective courses. Regarding the senior project option, EMD curricula are considering it as a core course.

The Cooperative Education and Alumni Relations Unit in PSU is assisting the university students in building a deeper understanding of their field, preparing them for the labor market, learn how to overcome all obstacles, merge them in the work environment to gain a genuine and authentic experience in a realistic atmosphere during their training in selected and distinguished companies. This is achieved through first-rate preparation and effective communication means, which aims to establish profound skills in information science, proper ethics, discipline, self-confidence, and cooperation with others. In addition, the unit builds good relationships with the labor market inside and outside the Kingdom of Saudi Arabia. It attempts to fulfill the university's goals by giving PSU students the chance to gain practical experience, thus preparing them for a successful future.

The PSU Co-op program requires the student to work for a Co-op training period of 27 weeks in his/her specialty area to receive ten academic credit hours. A student is qualified to enroll in the cooperative program if he/she meets the following PSU conditions: have completed more than 90 credit hours in the degree program; completed all the prerequisite courses required by the department; earned a major GPA of 2.00 or above. During the Co-op program, the student should continuously contact the academic advisor and the Co-op supervisor (Faculty members). The student must also complete his cooperative program before the end of his/her last semester. Alternatively, the student may spend a summer training period of 100 work hours for one credit hour (Internship). The student is considered qualified to enroll in the internship program if he/she completed more than 70 credit hours in his/her degree program. The student should complete the internship period before his/her last semester and enroll in three additional elective courses to fulfill the graduation requirement.

The PSU adopted grading scheme states that the grade of the Co-op program is given to the students based on the evaluation of all of the Co-op-organization, Co-op-supervisor, and two external examiners (Faculty members). The traditional grading system is applied to give the equivalent student grade according to his collected marks. Fundamental to note that the Co-op-organization gives 50% of the grade, and the university gives the other 50%. The university grade is given as 20% by Co-op-supervisor and 30% by the two external examiners. Co-op students can pass the Co-op program by achieving grades above 60%, similar to the traditional undergrad courses. The PSU Co-op student learning outcomes are currently assessed using an institutional assessment tool [25] using the students' achieved grades in different assignments given during the Co-op program.

According to the Co-op course specifications adopted in the construction management program (CMP) at PSU, upon successful completion of the Co-op program, the students shall be able to: (1) Analyze a problem, identify and define the engineering and management requirements suitable to its solution, (2) Use the techniques, skills, and modern engineering management tools practiced in the construction industries, (3) Demonstrate professional and ethical responsibility, (4) Demonstrate the ability to communicate effectively, (5) Recognize the need for lifelong learning, (6) Understand contemporary issues, (7) Effectively use job

search skills, such as resume preparation, interviewing, and decision-making skills, (8) Demonstrate the ability to effectively function as part of a multidisciplinary team, (9) Constructively receive and provide professional feedback.

3. Methodology

In this study, the cooperative programs' efficiency in building the necessary career-related work experience was investigated through a case study of Prince Sultan University (PSU) and its Co-op students and alumni (studying/working) from the Construction Management program (CMP). The assessment study performed was divided into two parts. First, indirect assessment has been conducted using a proposed set of indicators (5A's Layout). Two web-based surveys have been designed and utilized as a tool to collect data from employers about students' behavior and the skills they gained by the end of their Co-op Program (Employer Survey). Also, to collect the students' feedback about the quality of the offered Co-op program (Students Survey). The two surveys were implemented between September 2020 and December 2020 (During the Covid-19 Pandemic). This producer was successfully adopted in several previous studies (i.e., [26, 27]). In the second part, a direct assessment was performed to evaluate the student achievements in different intended learning outcomes that were expected to be gained through the Co-op program. This direct assessment was conducted based on the evaluation given by students themselves (Self-assessment), Employers, and Faculty using the proposed assessment method (SEF tool).

3.1 Indirect Assessment by Students and Employers

The first web-based survey (Students survey) has been designed and utilized as a tool to collect data about students' behavior. This survey was addressed to the whole Co-op students and Alumni community (studying/working) for the five batches 2015–2019. The student survey was structured as a confidential questionnaire format, divided into three sections with 35 questions. The first section consists of general demographic questions related to nationality, role in the university (Co-op student or Alumni), grade point average (GPA), and inquiry about receiving a job offer through the Co-op Training program. The second section comprised questions about the Co-op provider (The Organization) and the tasks assigned to the participant within his Co-op training. The provided choices included: Design or Development, Planning and Scheduling, Site Supervising or field works, Surveying and researches, Managerial Tasks, Administrative Tasks, or others. Finally, in the third section, participants were asked to select the most obstacles they faced during their Co-op program and if they would recommend the Co-op training option to other colleagues.

On the other hand, the second web-based survey (Employer Survey) has been designed and utilized to collect data about factors affecting employers' approval to train a PSU Student and their feedback about students' behavior during the Co-op Program. In addition, the Industry supervisors were requested to rate various indicators related to their satisfaction with the education level and the skills of the Co-op students. Besides, they were asked about their willingness to hire/train more PSU Co-op students/graduates in the future.

The provided choices in the two surveys were based on the adopted set of indicators (The 5A's Layout). Twenty-nine sub-indicators were considered in this indirect assessment, as mentioned in Table 1. Both students and employers were also requested to rate various items related to their satisfaction with the Co-op program's experience. Relative index analysis was used in this assessment study to weigh each indicator mentioned in Table 1 according to their relative importance. Relative importance index (RII) is an efficient and commonly used tool to prioritize indicators assessed on Likert-type scales. The following formula was used to determine the relative index [28] for each of the thirteen sub-indicators.

$$\text{Relative Importance Index (RII)} = \sum \frac{W}{A * N} \quad (1)$$

Where;

- W: is the weight given to each item by respondents, ranges from 1 to 5.
- A: is the highest weight (according to 5 points Likert-type scales).
- N: total number of respondents.

According to Akadiri 2011 [29], five importance levels (IL) can be aligned with the calculated RII values, as given in Table 2. The efficiency status that meets the calculated RII and the aligned IL are also addressed in the same Table. Thus, the relative importance index was calculated for each of the twenty-nine sub-indicators.

3.2 Direct Assessment of the Co-Op Program's Learning Outcomes

The adopted course learning outcomes (CLOs) in the CMP program (See Section 2) are somehow consistent with ones proposed with many other universities such as; University of Windsor [30,

Table 1. The 5A's Layout indicators used in the indirect assessment of the Co-op Program

Indicator	Description		Sub-indicator
Academic support	Planning and transparency		1. The following items were made clear to me at the beginning of my Co-op program: a. Work plan. b. Assessment criteria. c. Expected learning outcomes.
	Directness and Supervision		2. Support during the Co-op program: a. My Academic advisor was fully committed to supporting me. b. My field Co-op advisor was fully committed to supporting me.
	Off-campus support		3. Sources of help for me during the course, including Co-op advisor site visit hours and reference material, were made clear to me.
	Prior knowledge		4. Knowledge gained from other courses at PSU helped me accomplishing the tasks approved to me in the Co-op course.
Atmosphere	Available resources and facilities		5. The facilities needed during my Co-op program were available and up to date (resources, computers, operating manuals, materials, etc.)
	Working team		6. The Co-op helped me to develop my skills in working as a member of a team.
	Motivation		7. During the Co-op, I was encouraged to ask questions and develop my own ideas.
Assignments	Constancy		8. The conduct of the course and the things I was asked to do were consistent with the Co-op plan.
	Relevance		9. Tasks Assigned to you within the Co-op Training were relevant to Program (CMP/PMP).
	Rationality		10. The amount of work I had to do during the Co-op was reasonable for the credit hours allocates.
			11. The time allocated to complete the course work is suitable.
Assessment Criteria	Clearance and fairness		12. The things I had to do to succeed in the Co-op, including assessment tasks and criteria for assessment, were made clear to me.
			13. Select The Optimum Grading Scheme for the training Program.
Appraisal	Student Appraisal	a. Technical Skills & Theoretical Knowledge	14. The tasks I had to do during the Co-op were helpful for developing the knowledge and skills that I learned at PSU.
		b. Problem-solving	15. The Co-op helped me to improve my ability to think and solve problems rather than just memorize information.
		c. Flexibility and Resilience	16. The Co-op improved my ability to communicate effectively.
		d. Students overall satisfaction	17. Overall, I was satisfied with my Co-op (Students).
			18. Based on Your Experience, Rate the Training Program you had.
	Employers Appraisal	a. Can Think Independently	19. Take initiative in identifying and resolving problems and issues.
		b. Has leadership skills	20. Exercise leadership in pursuit of innovative and practical solutions.
			21. Provide leadership in their academic or professional community.
		c. Has concrete Theoretical Knowledge and practical skills	22. Apply the theoretical insights of inquiry from their field of study in the appropriate context.
			23. Apply the methods of inquiry from their field of study in the appropriate context.
			24. Propose solutions on academic or professional issues.
		d. Has protentional for Continuous professional development	25. Participate in activities to keep up to date with developments in their academic or professional fields.
		e. Has a Positive Belief & Attitude	26. Behave in ways that are consistent with Islamic values and beliefs.
			27. Use effective communication skills.
		f. Responsibility and Professional Attitude	28. Demonstrate a high level of ethical and responsible behavior (e.g., punctual, followed policies).
		g. Employer overall satisfaction	29. Overall, how would you rate your satisfaction with PSU graduates.

Table 2. Importance levels and the aligned decisions (After [29])

RII values	Importance level		Efficiency Status
$0.8 \leq RII \leq 1$	High	H	[5]: Not efficacious for University-to-career transition.
$0.6 \leq RII \leq 0.8$	High – medium	H – M	[4]: Fairly efficacious for University-to-career transition but requires considerable attention.
$0.4 \leq RII \leq 0.6$	Medium	M	[3]: efficacious for University-to-career transition, but requires minor attention.
$0.2 \leq RII \leq 0.4$	Medium – Low	M – L	[2]: Efficacious for University-to-career transition.
$0.0 \leq RII \leq 0.2$	Low	L	[1]: Very efficacious for University-to-career transition.

Table 3. SEF direct Assessment tool for evaluating the readiness of the Co-op student to join the labor market

Assessor	Description	Sub-indicator		Mapping with SO	Reference
Student Self-Assessment	Learning outcomes Achievements	**SO (1)** an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science, and mathematics.			ABET Standards for Engineering Management Program [33]
		SO (2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.			
		SO (3) an ability to communicate effectively with a range of audiences.			
		SO (4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.			
		SO (5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.			
		SO (6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.			
		SO (7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.			
Assessor	**Description**	**Sub-indicator**		**Mapping with SO**	**Reference**
Employer Assessment	Job Performance	Attendance & punctuality		SO (4)	PSU institutional evaluation form (B006)
		Meeting work plan requirements		SO (5)	
		Ability & enthusiasm to learn		SO (7)	
		Ability to apply knowledge		SO (7)	
		Quality of work produced (productivity)		SO (5)	
		Ability to follow instructions		SO (4)	
		Quality of report generation (if applicable)		SO (4)	
		Overall organization		SO (5)	
	Personal Characteristics	Conduct and discipline		SO (4)	
		Responsibility		SO (4)	
		Self-confidence & independence		SO (4)	
		Problem-solving skills		SO (1)	
		Creativity		SO (4)	
		General appearance		SO (4)	
		Cooperation with colleagues		SO (5)	
		Communication skills		SO (3)	
Faculty Assessment	Co-op-Supervisor	Task(s)		SO (2)	PSU institutional evaluation form (X002).
		New skill(s)		SO (7)	
		Meeting(s)		SO (3)	
		Problem(s)		SO (1)	
	External faculty examiners	Final Report	Covering all the suggested points in the final report template	SO (4) SO (6)	PSU institutional evaluation form (X003)
			Readability/Clarity	SO (3)	
			The authenticity of the report material.	SO (4)	
			Presence of Illustrative figures/ Charts/Tabular data, source codes, etc.	SO (3)	
			Creativity	SO (3)	
			Quality of the performed Co-Op activities	SO (7)	
		Presenta-tion	General Organization of the presentation	SO (3)	
			Consistency / Relevancy to the performed Co-Op activities	SO (7)	
			Presence of multimedia (Images, Audio, Video, Illustrative figures/ Charts/ Tabular data, etc.	SO (3)	
			Clarity of the talk	SO (3)	
		Discussion	Answers reflect student understanding of his work	SO (7)	
			Clarity of answers	SO (3)	

31]. However, those CLOs are contradictory with the adopted CLO's in the University of Washington, as reported by the ACI committee (2006) [32], since they lack the self-directed and self-motivated learning outcomes that are important for life-long learning. As discussed in the introduction section, those valuable skills are essential in the University-to-Career Transition stage. They transfer the student from the entire dependence on the instructor/mentor in obtaining information to a broader horizon in obtaining any information required after graduation. Therefore, student self-assessment should be given a weight in the direct Co-op student assessment. Therefore, a new assessment tool (SEF assessment tool) has been proposed in this study (Table 3).

As introduced in Table 3, the SEF assessment tool was designed to evaluate the Co-op student based on the students' self-assessment, employers, and faculty (including the Co-op supervisor and the two external examiners). The student learning outcomes of the Co-op programs in different universities are mostly mapped to the American Board of Engineering and Technology (ABET) program SO's (1–7). Therefore, the students were requested to choose the ABET SO's achieved within the Co-op program. This was considered as the student self-assessment part.

On the other hand, the grades given by both Co-op-organization and the faculty for 177 Co-op students from the batches 2015–2019 were collected and analyzed to directly assess the performance of the PSU students using the current direct assessment tool adopted in PSU mainly depends on the Employers and Faculty evaluation. The sub-indicators mentioned in the SEF Table are collected from the currently adopted PSU evaluation forms. However, those sub-indicators are re-organized and mapped to the seven ABET SO's in order to be comparable with the student's self-assessment results. The achievement percentages obtained based on the evaluation of both the Co-op organization and the faculty (Traditional assessment tool) were compared with the ones reported by the students to show how the student self-assessment may affect the overall evaluation of the Co-op program.

4. Results

Direct and Indirect assessment studies have been performed to investigate the nature of the Co-op programs offered to CMP students, the students' gained experiences upon completion of this training program, and the overall quality and efficiency of the program, and finally, the readiness of the Co-op students to start their career. The 5A's indicators model has been used for the indirect assessment, while the SEF tool was utilized for the direct one, considering the evaluation of Employers, Faculty, and the students (Self-Assessment). This section introduces the main results of both the direct and indirect assessments performed.

4.1 The Sample Characteristics

After data collection, the responses to the two surveys have been filtered out according to fulfilment and the time response. Then, the survey responses were analyzed using the Statistical Package for the Social Sciences (SPSS). About 177 questionnaires (Students Survey) were distributed to the whole of CMP's Co-op students and alumni community. A total of 73 completely answered responses (41% response rate) were collected through the Students' survey. Table 4 describes the characteristics of Co-op students and alumni groups.

A total of 73 survey response rates were obtained, including ten from Co-op students and 63 from alumni. This sample represents about 23% of the whole Co-op students and alumni available on the PSU campus. The main characteristics of the respondents are shown in Fig. 2. The sample could be classified into 13.7%, and 86.3% of the respondents were Co-op students and alumni, respectively.

The second web-based survey has been designed and utilized to collect data about factors affecting employers' approval to train the students and inquire about their feedback about the PSU stu-

Table 4. Sample description (N total = 73).

Characteristics (N = 73)		**Co-op Students (N = 10)**	**Alumni (N = 63)**
Nationality	Saudi	10%	23.8%
	Non-Saudi	90%	76.2%
Grade point average (GPA)	Less than 2	0%	0%
	Between 2 to 3	50%	38.1%
	Higher than 3	50%	61.9%
Did you receive a job offer through the Co-op Training	Yes	20%	34.9%
	No	80%	65.1%

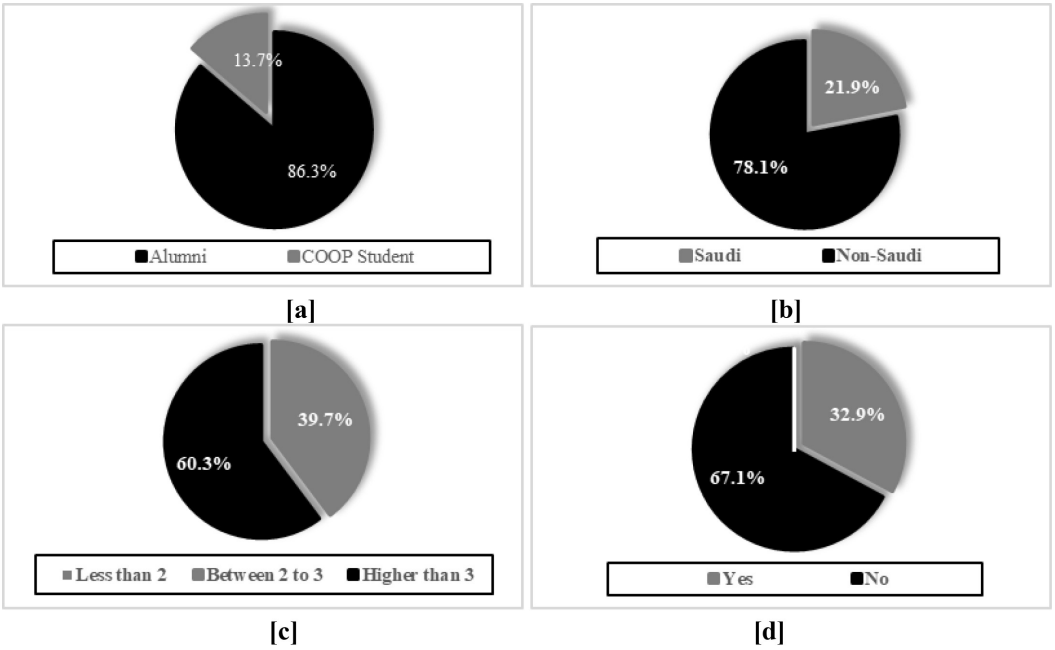


Fig. 2. Characteristics of the Sample (N total = 73). **[a]** Sample description. **[b]** Nationality. **[c]** GPA. **[d]** Receive a job offer through the Co-op Program.

dents' performance during the Co-op program. This survey was addressed to about 62 employers, and thirty-four (34) employers have entirely responded to the second survey (55% response rate). The factors affecting the employers' approval to train PSU students are summarized in Table 5.

Based on the employers' survey analysis (Table 5), 94% of them reported that student specialty and its relevance to his organization's needs was the main factor affecting their approval to train the Co-op student. Also, more than 85% of the employers agreed that the Student GPA and Soft skills are fundamentally important and control their selection. The analysis results also showed that the Saudi kingdom developed an ambitious plan (NTP, 2018) for the national transformation towards the Saudi Vision 2030 [24], also has a governmental effect on the employer's decision, as about 76.5% see that the nationality of the candidates affected their approval. Besides, 82.4% of them offer Co-op programs as a kind of their organization's community services.

Table 5. factors affecting the employers' approval to train PSU student

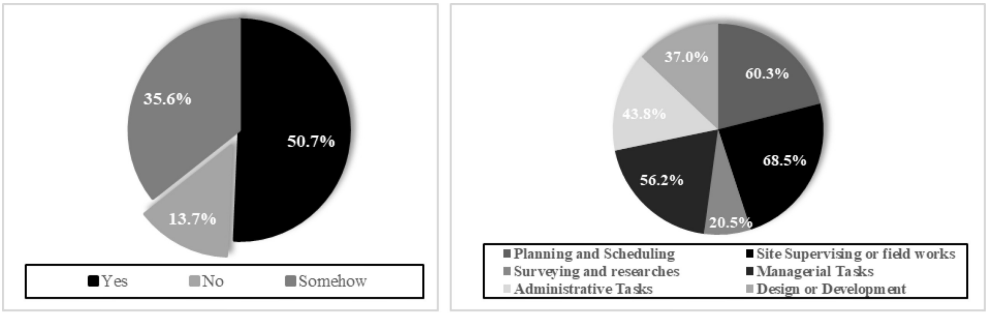
Factors Affecting Your Approval to train a PSU Student **N**	**Employer** **(N = 34)**
Student GPA	85.3%
Nationality	76.5%
Soft skills	88.2%
Student specialty is relevant to my needs	94.1%
It's kind of our company's community services	82.4%

4.2 Co-op Program Nature and the Gained Experience

The primary tasks assigned to students within their Co-op program are given in Table 6. According to

Table 6. The primary tasks assigned to students and the experience gained within their Co-op program

Nature of the assigned tasks & The gained experience		**Co-op Students (N = 10)**	**Alumni (N = 63)**
Tasks Assigned to you within the Co-op Training were relevant to Program (CMP/PMP)	Yes	10%	57.1%
	No	30%	11.1%
	Somehow	60%	31.7%
Nature of the assigned tasks within the Co-op Training	Planning and Scheduling	80%	55.6%
	Site Supervising or field works	80%	66.7%
	Surveying and researches	50%	17.5%
	Managerial Tasks	60%	58.7%
	Administrative Tasks	30%	44.4%
	Design or Development	50%	34.9%



[a] [b]

Fig. 3. Tasks assigned to the students within their Co-op program. **[a]** Tasks Assigned to you within the Co-op Training were relevant to Program (CMP/PMP). **[b]** Nature of the primary tasks assigned to PSU students.

the web survey results, as shown in Fig. 3a, about 50.7% of the respondents agreed that the tasks assigned within the Co-op program they had, were relevant to their academic program. Also, 35.6% see that the assigned tasks were somehow related to their academic background but not entirely relevant. On the other hand, the tasks assigned to about 13.7% of the respondent were not relevant to their academic program. The analysis based on the nature of assigned tasks (Fig. 3b) indicated that 68.5%, 60.3%, and 56.2% of respondents (CMP students) were assigned to tasks with the following natures; site supervision and field works, planning and scheduling, also design or development tasks, respectively, which are pertinent tasks to their academic program.

4.3 Indirect Assessment Results

This section introduces the main results of the indirect assessment performed to reflect on the quality of the Co-op programs based on students' and employers' responses received through the conducted surveys. The analysis was performed based on the 5A's Layout. In addition, each sub-indicator importance level (IL) has been calculated. Results of the indirect assessment performed are given in Table 7.

In general, the calculated ranks indicated that the offered Co-op program was efficacious for students and helped them develop the skills needed for their targeted career. Sixteen sub-indicators (out of 29) were ranked medium to low (M-L) importance level, reflecting the efficacy of the Co-op program in the university-to-career transition. However, minor attention may be required to raise the quality of the offered program, as indicated from the rank given to the eighteen and last sub-indicators that highlighting the overall satisfaction of both students and employers, respectively

The students confirmed that the Co-op helped them to improve their ability to think and solve problems rather than just memorize information (Sub-indicator No. 15). Also, they reported that it improved their skills in working as a team member and communicating effectively (sub-indicators No. 6 and 16). This may reflect the healthy atmosphere provided by the Co-op-organization and the students' self-confident behavior during working with a team. Besides, most of the students pinpointed that the evaluation of the appointed tasks during the Co-op was fair and reasonable, and the tasks assigned to them were reasonable for the credit hours allocates (sub-indicators 10 and 11).

The results of the indirect student self-assessment performed (Table 7) indicated that minor attention is required to enhance the Co-op programs in terms of the clearance of the Co-op work plan, assessment criteria, and the expected LOs before the beginning of the program since the first sub-indicators were ranked as a medium (M). Besides, although the students agreed that the academic advisor was fully committed to supporting them (sub-indicator No. 6), they see that the field Co-op advisor was not as same much commitment in support, and his role needs minor attention, as reported in the sub-indicator No. 2.a and b, respectively.

On the other hand, the feedback received from the employers was analyzed to assess the student performance within the Co-op programs. The results of the employer's assessment performed are also given in Table 7. Overall, the employers reflected that they were satisfied with students' performance within the Co-op program. This can be seen in the given rank (M-L) for the last sub-indicator No.28, which indicated that the training program was efficacious for the student's university-to-career transition. As reported by the employers, students demonstrated a high level of ethical, responsible, and professional behavior. They also were effective in identifying, resolving problems, and in using their communication skills. In the same line, Co-op students succeeded in applying the methods acquired from their field of study in the appropriate context (sub-indicators 19–

Table 7. The 5A's Layout indicators used in the indirect assessment of the Co-op Program

Indicator	Description		Sub-indicator	RII	IL	Efficiency Status
Academic support	Planning and transparency		1. The following items were made clear to me at the beginning of my Co-op program: a. Work plan b. Assessment criteria c. Expected learning outcomes.	0.463	M	Efficacious for University-to-career transition, but requires minor attention.
	Directness and Supervision		2. Support during the Co-op program: My Academic advisor was fully committed to supporting me. My field Co-op advisor was fully committed to supporting me.	0.375 0.416	M-L M	Efficacious for University-to-career transition. Efficacious for University-to-career transition, but requires minor attention.
	Off-campus support		3. Sources of help for me during the course, including Co-op advisor site visit hours and reference material, were made clear to me.	0.447	M	Efficacious for University-to-career transition, but requires minor attention.
	Prior knowledge		4. knowledge gained from other courses at PSU helped me accomplishing the tasks approved to me in the Co-op course.	0.419	M	Efficacious for University-to-career transition, but requires minor attention.
Atmosphere	Available resources and facilities		5. The facilities needed during my Co-op program were available and up to date (resources, computers, operating manuals, materials, etc.).	0.416	M	Efficacious for University-to-career transition, but requires minor attention.
	Working team		6. The Co-op helped me to develop my skills in working as a member of a team.	0.386	M-L	Efficacious for University-to-career transition.
	Motivation		7. During the Co-op, I was encouraged to ask questions and develop my own ideas.	0.367	M-L	Efficacious for University-to-career transition.
Assignments	Constancy		8. The conduct of the course and the things I was asked to do were consistent with the Co-op plan.	0.438	M	Efficacious for University-to-career transition, but requires minor attention.
	Relevance		9. Tasks Assigned to you within the Co-op Training were relevant to Program (CMP/PMP).	Yes: 50.7%		
	Rationality		10.The amount of work I had to do during the Co-op was reasonable for the credit hours allocates.	0.427	M	Efficacious for University-to-career transition, but requires minor attention.
			11. The time allocated to complete the course work is suitable.	0.386	M-L	Efficacious for University-to-career transition.
Assessment Criteria	Clearance and fairness		12. The things I had to do to succeed in the Co-op, including assessment tasks and criteria for assessment, were made clear to me.	0.466	M	Efficacious for University-to-career transition, but requires minor attention.
			13. Select The Optimum Grading Scheme for the training Program.			
Appraisal	Student Appraisal	a. Technical Skills & Theoretical Knowledge	14. The tasks I had to do during the Co-op were helpful for developing the knowledge and skills that I learned at PSU.	0.441	M	Efficacious for University-to-career transition, but requires minor attention.
		b. Problem-solving	15. The Co-op helped me to improve my ability to think and solve problems rather than just memorize information.	0.384	M-L	Efficacious for University-to-career transition.
		c. Flexibility and Resilience	16. The Co-op improved my ability to communicate effectively.	0.364	M-L	Efficacious for University-to-career transition.
		d. Students overall satisfaction	17. Overall, I was satisfied with my Co-op (Students).	0.414	M	Efficacious for University-to-career transition, but requires minor attention.
			18. Based on Your Experience, Rate the Training Program you had.	0.444	M	Efficacious for University-to-career transition, but requires minor attention.
	Employers Appraisal	a. Can Think Independently	19. Take initiative in identifying and resolving problems and issues.	0.335	M-L	Efficacious for University-to-career transition.
		b. Has leadership skills	20. Exercise leadership in pursuit of innovative and practical solutions.	0.365	M-L	Efficacious for University-to-career transition.
			21. Provide leadership in their academic or professional community.	0.306	M-L	Efficacious for University-to-career transition.
		c. Has concrete Theoretical Knowledge and practical skills	22. Apply the theoretical insights of inquiry from their field of study in the appropriate context.	0.365	M-L	Efficacious for University-to-career transition.
			23. Apply the methods of inquiry from their field of study in the appropriate context.	0.347	M-L	Efficacious for University-to-career transition.
			24. Propose solutions on academic or professional issues.	0.388	M-L	Efficacious for University-to-career transition.
		d. Has protentional for Continuous professional development	25. Participate in activities to keep up to date with developments in their academic or professional fields.	0.288	M-L	Efficacious for University-to-career transition.
		e. Has a Positive Belief & Attitude	26. Behave in ways that are consistent with Islamic values and beliefs.	0.224	M-L	Efficacious for University-to-career transition.
			27. Use effective communication skills.	0.241	M-L	Efficacious for University-to-career transition.
		f. Responsibility and Professional Attitude	28. Demonstrate a high level of ethical and responsible behavior (e.g., punctual, followed policies).	0.224	M-L	Efficacious for University-to-career transition.
		g. Employer overall satisfaction	29. Overall, how would you rate your satisfaction with PSU graduates.	0.288	M-L	Efficacious for University-to-career transition.

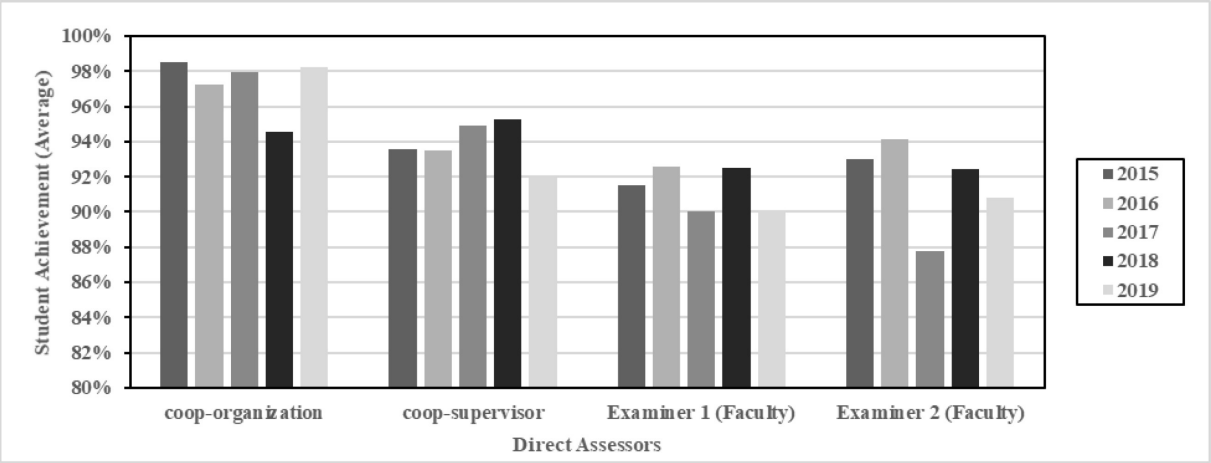


Fig. 4. The given grades by the Co-op-organization, Co-op-supervisor, and the two external faculty examiners for the students of the Construction Management Program (CMP).

29), which meet the requirements of the new management strategies.

4.4 Direct Assessment of the Co-Op Students Achievements

The adopted grade distribution in PSU for the Co-op program was explained before in the methodology section. As planned, the Co-op students and alumni results during the period of 2015–2019 were collected and analyzed to assess the performance of the Co-op students directly. The average grades given to the Co-op students by the Co-op company, Co-op-supervisor, and the two external faculty examiners are summarized in Fig. 4.

It can be seen from the results presented in Fig. 4 that the average total grade of the Co-op students from CMP was ranged from 92% to 95%, which may indicate the efficiency of the Co-op program in helping students to achieve the intended LOs. However, it was noted that the grades given by the Co-op organization were greater than the grades given by both the Co-op-supervisor and the two external examiners. This was almost consistent for the five batches. In contrast, the grades given by the two external examiners were almost consistent with each other, as indicated in the five batches results. Grades of the five batches (2015–2019) were used to directly assess the students' learning outcomes using the PSU assessment tools, as summarized in Fig. 5. As shown, the direct assessment using the current traditional tool indicated that student's achievement percentage in each of the seven ABET SO's was high (above 92% and up to 100%). This was almost consistent for the

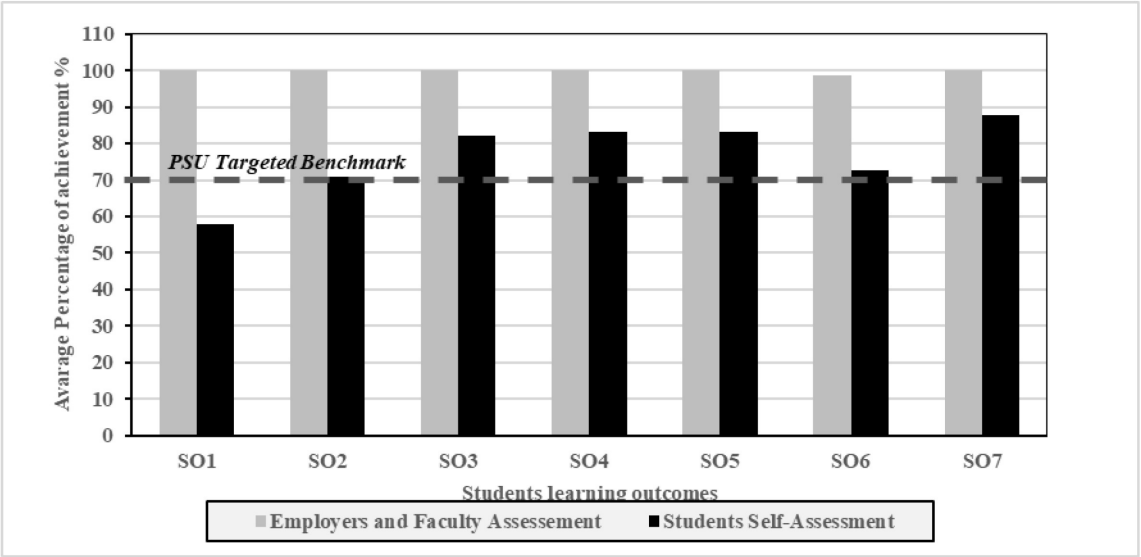


Fig. 5. Direct assessment results of the CMP students' achievements in each ABET learning outcome by the end of this Co-op Program (Based on PSU and SEF assessment tools).

five batches. Those results may raise a question about the reliability of the utilized grading scheme and assessment tools in evaluating the students' performance within the Co-op programs. On the other side, traditional PSU assessment tool results have been compared with the students' self-assessment results obtained using the proposed SEF tool, as demonstrated in Fig. 5.

As exposed in Fig. 5, nearly 90% of respondents nominated the last program learning outcome (SO 7) as the most achieved learning outcome gained from the Co-op program. Also, more than 80% of students agreed that SO 3, SO 4, and SO 5 were achieved within the Co-op program. On the other side, less percentage of the respondent (58.9%, 71%, and 72.6%) see that they achieved the first, second, and seventh learning outcomes, as highlighted in Fig. 5. SEF assessment results showed that the percentage of students who achieved the PSU targeted benchmark (70%) is considerably higher than the 70% target, except for the first SO. While the results obtained using the traditional assessment tool pinpointed that all SOs achievement percentages have significantly exceeded the 70% target.

4.5 Obstacles and Factors Affecting the Co-Op Efficiency

Students were requested to report if they experienced different obstacles during their Co-op programs. Tables 8 summarizes the students and alumni most reported Obstacles during their training period. Noteworthy to state that the addressed obstacles were collected from field experience reports conducted by the Co-op supervisors and the feedback received from the Co-op students each semester. Besides, many universities globally are currently struggling with how to respond to the consequences of the COVID-19 pandemic on the education process [27]. Most education systems recommended switching to distance learning to protect the students and eliminate the virus spreading within the campuses. In addition, many companies adopted similar actions such as work from home techniques to eliminate the virus spreading. These recent changes may also be a significant barrier to the efficient university-to-career transition process; therefore, the students were requested to report whether if COVID-19 pandemic affected their Co-op program or not.

Very limited positions available, and trainers were so busy and didn't give enough time, were nominated as the most substantial obstacles to have an efficient Co-op program (Fig. 6) as chosen by 47.9% and 42.5% of the student sample, respectively. Also, about 23.3% agreed that the tasks assigned to them were far from their specialty. This may be attributed to a shortage in the planning phase and the student assigning processes; it can also be explained by a lack of student's self-awareness and self-criticism skills, which are vital, especially during the university-to-career transition interval. However, as shown in Fig. 6, only 19.2% of the respondents reported that there was no advisor or mentor available to guide during the Co-op program. On the other side, the training period was not enough, the trainers were not qualified enough, and my Co-op supervisor was not supportive; those three proposed Obstacles were low-rated by the two groups of respondents. This can indicate that the adopted training period (7 months) by PSU is a reasonable period for the university to career transition..

Near about half of the respondents (47.9%) agreed that it was very complicated to get accepted and have a Co-op training opportunity (Fig. 6), as presented. Student GPA and soft skills were the most governmental factors that control employers' decisions to train the student (Table 5). Despite that, about 60% of the students who participated in this study had a GPA higher than 3 out of 4 (Fig. 2c).

4.6 Co-Op Program Overall Satisfaction

Students were also requested in the web-based survey to reflect on the optimum grading scheme for the training program. The feedback received

Table 8. Obstacles faced during the Co-op Program

Obstacles you faced during your Co-op Training Program N		**Co-op Students (N = 10)**	**Alumni (N = 63)**
Trainers were so busy and didn't give me enough time		40%	42.9%
The tasks assigned to me were far from my specialty		30%	22.2%
The Trainers were not qualified enough		0%	11.1%
No advisor or mentor was available to guide me		10%	20.6%
My Co-op Supervisor was not supportive		10%	9.5%
Training time period was not enough		10%	12.7%
Very limited positions available, it was very complicated to get accepted		40%	49.2%
The current COVID-19 Pandemic Affect the training Program (In case your Co-op was during the pandemic)	Yes	60%	7.9%
	No	40%	92.1%

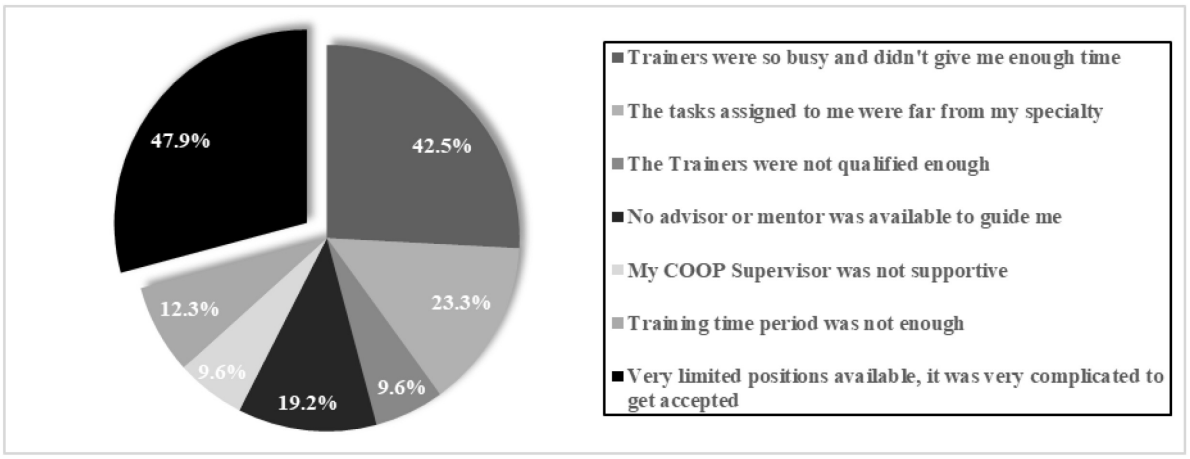


Fig. 6. Obstacles faced during the Co-op Training Program (N = 73)

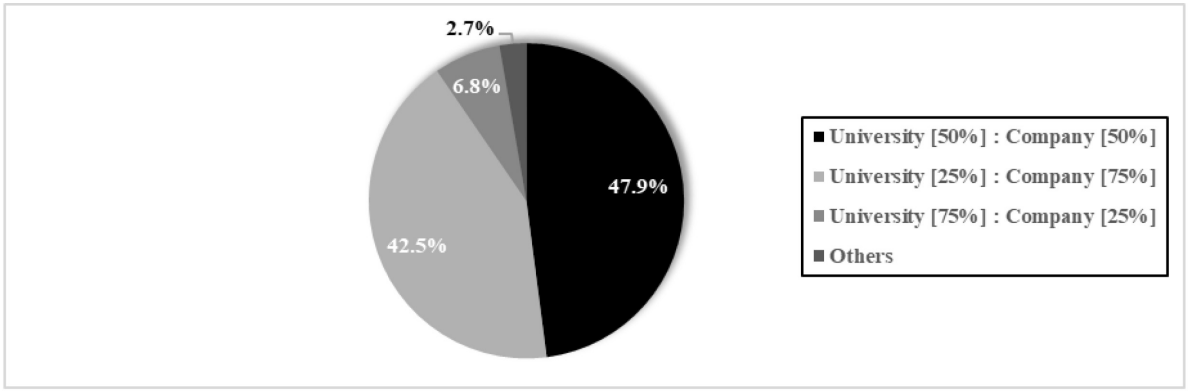


Fig. 7. The Selected Optimum Grading Scheme by the students for the Co-op Program.

Fig. 8. [a] Students feedback about the Co-op program they had (Would you recommend the Co-op training option to other colleagues. **[b]** Would you recommend your Co-op organizations to hire/ train PSU graduates.

from the students and alumni is summarized in Fig. 7. As shown, near 50% of respondents agreed that the adopted grading (50% by the university and 50% by Co-op company) distribution is the most appropriate one. However, about 43% of the respondents see that the Co-op grades should be distributed as 25% to be given by the university and 75% has to be given by the Co-op organization.

Students were also requested to reflect on their satisfaction regarding the Co-op program and the Co-op organization. As shown in Fig. 8a, about 90% of the students recommended the Co-op training option for their colleagues. Also, about 97% of the respondents were satisfied with the Co-op organization they trained with and nominated those organizations for future cooperation with the university.

On the other side, the feedback received from the employers showed that about 97% of them would recommend their Co-op organizations to hire/ train PSU graduates, as shown in Fig. 8b. This may be explained why about 70% of the PSU students received job offers through the Co-op Program, as pinpointed before in Fig. 2d.

5. Discussion

No doubt, the cooperative program has a remarkable role in the university-to-career transition phase. The real-life experiences gained by Co-op students are for sure improving their readiness to join the labor market. Also, promote their chances to get jobs once they graduate or maybe, in some cases, before graduation. Results of the study performed indicated that 70% of PSU construction management Co-op students had received job opportunities through the Co-op program. This is also consistent with the University of Limerick graduates [6]. In the same line, the employer survey showed that 97% of the employers would recommend their Co-op organizations hire/ train PSU graduates. The Co-op organization's needs can explain this, as 94% of the employers reported that student specialty and its relevance to his organization's needs was the main factor affecting their approval to train/hire the Co-op student. This agrees with Ramirez et al. [34] conclusions which highlighted that the potential of the co-op employers to advertise or interview engineering students was mainly based on the student major. The uniqueness of the construction management program offered in PSU has contributed to distinguish the CMP students from the senior students of other traditional civil engineering programs.

Feedback from students and employers is very important to assess the offered Co-op programs' quality and devise actions that can improve the program. It is necessary to adopt appropriate planning and management policies needed to improve the whole academic program continuously. It can be observed from the result of the indirect assessment performed that employers were more satisfied with the offered Co-op program more than the students as they ranked most of the sub-indicators assigned to them as M, and they see that the Co-op program was efficacious for university-to-career transition. On the other side, the students also agreed that the Co-op program was efficacious for university-to-career transition, but minor attention is required to raise the overall quality of the offered training program. This was also consistent in the direct assessment results. The grades given by the co-op organization were relatively high compared with the grades given by the co-op supervisor and the external examiners. Most Co-op students got grades ranging from 94 to 98 out of 100 in the employers' evaluation (See Fig. 4). This may indicate the unreliability of the employers' evaluations. The same findings were also found by Faiz and Al-Mutairi [35]. A precise rubric should be designed by faculty members in cooperation with industry experts to be adopted for the direct assessment of the Co-op organization to ensure the reliability of the given grades and how it reflects the student's actual performance.

The well-designed learning outcomes of the Co-op program are fundamental to ensure the efficient university-to-career transition process and accurately specify the real-life skills the students should gain by the end of the Co-op program, especially with rapidly changing market needs. With that in mind, the adopted LOs in CMP were reviewed, and they were found to be consistent with those adopted in different international universities, such as the University of Windsor [30, 31]. However, they also contradict the ones adopted in other universities like the University of Washington [32] since they lack the self-directed and self-motivated learning outcomes that are important for life-long learning. This difference in the Co-op learning outcomes may be attributed to the differences between national and international accreditation systems adopted in each university. With the rising deregulation and free competition, the industry may be driven by global competitiveness, and hence there is a need for more globalized learning outcomes for the Co-op programs. Those globalized learning outcomes should be designed based on the nature of the program major and the appointed task with the program. Co-op organizations should also be consulted in the designing of those globalized learning outcomes.

Self-directed and self-motivated learning outcomes are essential in the University-to-Career Transition stage. They transfer the student from the entire dependence on the instructor/mentor in obtaining information to a broader horizon in obtaining any information required after graduation. Therefore, a new assessment tool (SEF assessment tool) has been proposed in this study (Table 3), considering a weight for the student self-assessment. Each student was requested to select the achieved learning outcomes based on ABET standards. Results of the direct assessment using the traditional tool (ignoring the student's self-assessment) indicated that the student's achievement percentage in each of the seven ABET SO's was high (above 92% and up to 100%). This contradicted the student's self-assessment results, obtained using the SEF assessment tool, as students' achievement percentages ranged from 58% to

almost 90%. Therefore, the assessment results considering the students' self-assessment seems more logical. The SEF direct assessment results showed that the Co-op students had achieved the targeted benchmark (70%) in all SO's, except for the first SO. This may be attributed to the nature of this SO as it might be relatively close to the undergraduate course nor the field training experience they had within the Co-op. This can also be strengthened by the results of the indirect assessment performed (Table 7), as the respondent reported that the Co-op helped them improve their ability to think and solve problems rather than memorize information (Sub-indicator No.15).

The efficiency of the Co-op program was affected by many factors. The nature of the appointed tasks was one of the most factors affecting the real-life experiences gained with the Co-op. Nearly half the respondents (50.7%) agreed that the assigned tasks were relevant to their academic program. The assigned tasks included; site supervision and field works, planning and scheduling, also design or development tasks, respectively, which are pertinent tasks to their academic program (Engineering Management). Despite that, about 42% of the student sample reported being assigned to some administrative tasks within their Co-op. This may raise a question about the influential role of the Co-op supervisor during the program. The results of the indirect student self-assessment performed (Table 7) indicated that the field Co-op advisor role needs minor attention, as reported in the sub-indicator No. 2a and b, respectively. Co-op supervisors should not only monitor the student progress during the training program but also should fulfill the gap between academic and career life and help students in overcoming the obstacles they may face during the Co-op program, such as the not enough time given by the Co-op-trainers. In the same line, the results of the indirect assessment performed (Table 7) indicated that minor attention is also required to enhance the Co-op programs in terms of the clearance of the Co-op work plan, assessment criteria, and the expected LOs before the beginning of the program since the first sub-indicators were ranked as a medium (M).

According to the CMP curriculum, the Co-op course has the highest number of credit hours compared to other courses in the program. This is consistent with the various comparable programs, as Faiz and Al-Mutairi [35] reported. With that in mind, the grading scheme of the Co-op might be an issue as the achieved grade in Co-op would significantly affect the student GPA. The feedback received from the students and alumni showed that nearly half of respondents agreed that the adopted grading distribution (50% for the university and 50% for the Co-op organization) is appropriate. However, about 43% of the respondents see that Co-op grades should be distributed as 25% for the university and 75% should be given by the Co-op organization. Furthermore, most of the student sample agreed that the adopted training period (7 months) by PSU was reasonable for the university to career transition. This is also consistent with the adopted scheme in several engineering institutions such as the University of Florida at Gainesville [36] and the University of California at Berkeley, USA [10].

5.1 Limitations of the Study

Although the study shows the importance of the co-op program in the university-career transition process, there are several limitations associated with the study. The study was mainly dependent on one engineering program that presented as a case study. The factors investigated in this study that affect the Co-op program's efficiency were mainly selected based on the availability of the dataset. However, other factors potentially affect the co-op student engagement and the expected outcomes, such as social, cultural, and economic factors and individual student factors, such as family background, career intentions, parental education, and socio-economic status [17].

6. Conclusions

This study explored the role of the Co-op programs in university-to-career transition through a case study of the engineering management students of prince sultan university. Direct and Indirect assessment studies have been performed to investigate the nature of the Co-op programs offered to the five student batches (2015–2019) of the Construction Management program (CMP), the students' gained experiences upon completion of this training program, the overall quality and efficiency of the program, and the readiness of the Co-op students to start their career. The 5A's indicators model has been used for the indirect assessment, while the SEF direct assessment tool was proposed to evaluate the student learning outcomes achieved by the end of the Co-op program, considering the evaluation of Employers, Faculty, and the students (Self-Assessment).

The real-life experiences gained by Co-op students improved their readiness to join the labor market. Also, it significantly promoted their chances to get jobs once they graduate or maybe, in some cases, before graduation. Results of the study performed indicated that 70% of PSU construction management Co-op students had received

job opportunities through the Co-op program. In addition, 97% of the employers would recommend their Co-op organizations hire/train PSU graduates. The employer's survey analysis showed that 85% of the employers agreed that the Student GPA and Soft skills are fundamentally important and control their selection. However, 94% of the employers confirmed that student specialty and its relevance to his organization's needs were the primary and governmental factors affecting their approval to train/hire the Co-op students. Thus, the uniqueness of the construction management program offered in PSU had contributed to distinguish the CMP students from the other senior students of traditional civil engineering programs, which was reflected in their employment rate.

Results of the indirect assessment revealed that the offered Co-op program for CMP students was efficacious and assisted in developing the needed skills for the targeted career. However, there are some weak points that should be addressed to improve the quality of the program. As reported by both the students and employers, sixteen sub-indicators (out of 29) were ranked as a medium to low (M-L) importance level, reflecting the efficacy of the Co-op program in the University-to-career transition. Despite that, minor attention is required to enhance the Co-op program's quality in terms of the clearance of the work plan, assessment criteria, and the expected learning outcomes before the beginning of the program. Besides, although the students agreed that the academic advisor was fully committed to supporting them (Sub-indicator No. 6), they claimed the role of the field Co-op supervisor.

The direct assessment study highlighted that the current direct assessment tool utilized in PSU only relies on the evaluation of the Co-op organization and the faculty, either the Co-op supervisor or the external examiners, and ignores the student self-assessment. However, the self-directed and self-motivated learning outcomes are essential in the University-to-Career Transition stage. They transfer the student from the entire dependence on the instructor/mentor in obtaining information to a broader horizon in obtaining any information required after graduation. Therefore, a new assessment tool (SEF assessment tool) has been proposed in this study, considering a weight for the student self-assessment. The direct assessment results showed that the student achievement results obtained using the SEF tool were more reliable than those determined using the traditional assessment method. Noteworthy to address that the grades given by the co-op organization were relatively high compared with the grades given by the co-op supervisor and the external examiners. Most Co-op students got grades ranging from 94 to 98 out of 100 in the employers' evaluation. This may indicate the unreliability of the employers' evaluations.

The study also focused on the nature of the tasks assigned to the students during the training program and how it assists in building the real-life work experience needed to prepare the student to join the labor market. The nature of the appointed tasks was one of the most factors affecting the real-life experiences gained with the Co-op. Nearly half the respondents (50.7%) agreed that the assigned tasks were relevant to their academic program. The assigned tasks included; site supervision and field works, planning and scheduling, also design or development tasks, respectively, which are pertinent tasks to their academic program (Engineering Management). Despite that, about 42% of the student sample reported being assigned to some administrative tasks within their Co-op.

The feedback received from the employers was analyzed to assess the student performance within the Co-op programs. Overall, the employers reflected that they were satisfied with students' performance within the Co-op program. This can be seen in the given rank (M-L) for the last sub-indicator No.28. Employers also confirmed that students demonstrated a high level of ethical, responsible, and professional behavior. They also were effective in identifying, resolving problems, and in using their communication skills. In the same line, Co-op students succeeded in applying the methods acquired from their field of study in the appropriate context (sub-indicators 19-29), which meet the new management strategies' requirements and clearly indicate that the training program was efficacious for the student's university-to-career transition.

Overall, the Co-op students were very satisfied with the offered program. Nearly 90% of the students recommended the Co-op training option for their colleagues. Also, about 97% of the students were satisfied with the Co-op organization they trained with and nominated those organizations for future cooperation with the university. Besides, nearly half of respondents agreed that the adopted grading distribution (50% for the university and 50% for the Co-op organization) is appropriate, and the adopted training period (7 months) by PSU was reasonable for the university to career transition.

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