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Course-Based Work-Integrated Learning in Engineering Education: A Case Study of Short-Term Industry Placements

Miranda Kedbäck[1*] and Victor Hedén[1]

[1] School of Engineering Science, University of Skövde, Sweden

[*]E-mail: miranda.kedback@his.se

Abstract. Work-Integrated Learning (WIL) in higher education is recognised for linking academic knowledge with professional practice, yet traditional long-term placements are resource-intensive and challenging to coordinate. This study explores the feasibility of a short-term, course-based WIL process within engineering education. A six-week WIL process was developed and integrated into a third-year course in a bachelor's programme in manufacturing engineering. Five students were placed individually or in pairs at three manufacturing companies from different sectors and of different sizes, attending one to two days per week. A common assignment was provided for all students, with flexibility for company-specific adaptation. Semi-structured interviews with students and company supervisors constituted the evaluation. The data analysis identified consistent benefits; students reported enhanced ability to connect theory and practice and increased professional understanding, while supervisors noted organisational learning benefits through students' fresh perspectives and critical reflection. However, challenges included limited preparation, communication gaps, and difficulties adapting a generic assignment to diverse industrial contexts. Suggested improvements included more structured preparation, clearer communication of expectations, customised assignments, and consideration of shorter, full-time placements. The findings demonstrate that short-term, course-based WIL can complement traditional placements by offering meaningful learning opportunities and strengthening university-industry collaboration. Although, the results also suggest that effective implementation requires structural adjustments to support preparation, communication, and contextual alignment. Future research should refine the process by testing scalability with larger student groups, additional companies, and international participants, as well as further investigating critical success factors for short-term WIL.

1. Introduction

Work-Integrated Learning (WIL) is an educational strategy where work-based experiences provide students with the opportunity to integrate theory with practice of work [1]. The integration of this strategy in engineering curriculum is particularly important, as WIL activities are key contributors to student learning related to the understanding of complex processes and diversity in a social context [2]. Successfully implemented WIL benefits all three stakeholders: students, universities, and companies [3]. For students, these include opportunities for practical

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work experience, enhanced employability, and increased readiness for industry roles [3–5]. In engineering, work-industry related activities have proved to increase student motivation [6]. For universities, WIL can increase the quality of education, improve industry collaborations, increase attraction for students, and obtain higher research funding from industries [3]. Companies benefit from WIL arrangements through the availability of industry-ready graduate engineers, cost-savings in recruitment, and increased popularity via students and universities [3]. Also, students could contribute with the identification of potential industrial problems and generate solutions [7].

In higher education, WIL often takes the form of long-term placements, such as co-operative or internship education models that alternate semesters between academic and industry work, typically ranging from 12 weeks to six months [8]. While effective, such arrangements require extensive logistical coordination and can be difficult to integrate into already packed engineering curricula [3]. Shorter, course-based WIL models have the potential to broaden access, reduce extensive coordination, and increase flexibility [9]. Developing and evaluating such models and processes, with attention to both educational outcomes and industry engagement, would therefore potentially benefit engineering education. This study proposes a process for the implementation of course-based WIL activities in engineering education, where the industry placement is concentrated to a shorter time frame compared to traditional WIL. This form of WIL seeks to improve the students' connection to working life during their academic studies, as well as to strengthen the collaboration between academia and industry, without requiring extensive coordination or changes to the engineering curriculum. The objectives of the study are to 1) develop a process of short-term, course-based WIL, based on critical success factors identified in the literature, and 2) through a case study, implement and evaluate the process. In the following sections, the theoretical background is presented, as well as the case study set-up, the findings, the discussion, conclusions, and future work.

2. Theoretical Background

This section presents the conceptual background that informed the case study. Drawing on prior work on WIL and short-term industry placements in engineering education, it identifies key factors that guided the development and implementation of the case study described in Chapter 3. Section 2.1 situates the case study within existing forms of WIL, while Section 2.2 details the critical success factors identified in prior research for developing and implementing short-term WIL. Together, these perspectives informed the development of the case study as well as the interpretation of the findings presented in Chapter 4.

2.1 Forms of Work-Integrated Learning

Work-Integrated Learning (WIL) exists in many different forms, where they all integrate academic learning with professional practice in various ways. While these models share a commitment to bridge theory and practice, they differ substantially in structure, duration, expectations, and suitability for engineering. Among the established, longer forms of WIL are the concepts of co-op, internships, apprenticeships and enhanced WIL. Co-op is a form of WIL where students alternate between full-time academic study and full-time paid employment in industry, typically lasting four to eighteen months in total [10]. Employers in engineering have rated co-op students highly in terms of technical knowledge, professional attributes, and workplace readiness [11]. A distinguishing feature of co-op is that students are hired as employees rather than interns or volunteers, which shapes the expectations of partner organisations [12]. However, co-op requires

strong institutional support, sufficient placements, and committed employer supervision in order to succeed [8].

Internships share similarities with co-op, but typically run for three to four months and consist of a single work placement rather than multiple alternating terms [8]. Like co-op, internships in engineering are often paid, though practices differ across regions [10]. Challenges include the struggle to identify suitable projects, provide sustained supervision, and align student assignments with organisational needs [13]. Apprenticeships represent an even more long-term form of WIL, in which students are employed throughout the duration of their degree [14]. This approach has clear benefits for employability, but it also requires sustained employer investment in students and depends heavily on supportive organisational structures. Another approach is to embed WIL into the curriculum across all semesters through the Enhanced Work-Integrated Learning (EWIL) model, ensuring regular exposure to industry without requiring lengthy placements [15]. The model proposes weekly or monthly patterns where students spend part of each week at university and part in industry [15]. For engineering education, EWIL addresses the problem of insufficient workplace exposure in traditional programmes, but requires universities and employers to establish sustainable collaboration as with all long-term forms of WIL.

In recent years, short-term, more flexible forms of WIL have emerged. Micro-internships, a concept mostly found in the US, provide short, project-based opportunities, typically lasting between one and four weeks or involving 5-40 hours of work [16–18]. Other forms of short-term WIL are Intensive Work-Integrated Learning (IWIL) or Problem-Based Learning (PBL) events. A PBL event study in Germany [19] expanded over only a few days and still fostered employability skills such as project management, collaboration, and communication. Similarly, benefits of intensive WIL models have been identified in a study in Australia [9], including flexibility of format, accessibility for diverse student groups, and opportunities for multiple shorter engagements with industry. At the same time, challenges remained in designing projects of suitable scope and ensuring adequate supervision within condensed timeframes [9]. These short-term forms of WIL have been shown to foster professional development, industry connections, and a sense of belonging in the field, despite the short time frame. The flexibility makes them accessible for students and attractive for companies unable to host longer placements. Yet, their effectiveness depends on structured mentoring, scaffolding, and realistic alignment between academic and workplace expectations. In engineering, short-term forms of WIL emerge as a promising complement to more traditional, longer forms of WIL.

2.2 Critical Success Factors for Short-Term Work-Integrated Learning

When developing a process for the implementation of short-term WIL, there are different factors that need to be taken into consideration. Some of the challenges that might arise are specific to managing short-term placements, where others are common for all forms of WIL. Prior research has identified a range of critical success factors for work-integrated learning, including pedagogical alignment, supervision and support, assessment design, and organisational and logistical conditions. The critical success factors identified in the literature, that specifically studies short-term WIL, include establishing relationships with companies, providing sufficient institutional resources and processes, aligning the student project with company expectations and curriculum, and providing effective supervision and student preparation as well as continuous follow-ups throughout the process.

2.2.1 Relationship with Companies

Establishing long-term, reciprocal relationships, where both university and companies see clear benefits, facilitates commitment and ongoing collaboration [11,12]. This includes proactively supporting collaboration with industry partners by highlighting mutual benefits and addressing barriers to company engagement through sustained relationship-building [7,13]. Close cooperation between the university and participating companies is crucial when discussing and negotiating project assignments and placement activities [9]. Another important aspect is to support companies in recruitment, supervision, mentoring, and assessment, while clarifying expectations and building shared understanding of the WIL framework [11,13]. Clear, regular communication between university teachers and workplace supervisors is crucial, as well as collaborative evaluations of the WIL experience [9].

2.2.2 Institutional Resources and Established Processes

Developing coordinated processes that supports the WIL activity and ensures institutional resources are crucial to a successful outcome of WIL [3]. This includes providing sufficient preparation and support for students and ensuring continuous improvement processes [12]. It also requires established processes within the university to recruit and coordinate industry partners, as well as to provide supervisor training [11]. The school also has to provide enough resources to manage regular communication with workplaces, and post-placement support for the students [9].

2.2.3 Project Design and Alignment with Curriculum

Ensuring that student projects or assignments are feasible and aligned with company needs and student learning outcomes is particularly important in short-term placements due to the short time frame [9]. The project scope needs to be carefully planned and delimited on beforehand, as the student will have limited time adjusting the assignment once on-site. Moreover, the WIL activity needs to be planned with other courses or activities that the students might have in parallel. To ensure success in the implementation of a WIL activity in already existing courses or programmes, it is essential to map course or project design against quality frameworks [9]. This enables both the identification of problems and feedback-based continuous improvement [9,12].

2.2.4 Supervision, Follow-Ups, and Student Preparation

Providing a regular supervision structure is needed, as well as trained company and university supervisors who facilitate learning goal setting and continuous reflection activities, ensuring students' professional growth [5,9]. Also, it is essential especially in short-term WIL activities to equip students with the necessary tools and guidance well before the placement, and provide structured follow-up activities to consolidate learning [9]. In cases with longer company placements, some of these activities can be done during the project period, but in the case of short-term WIL the importance of preparation increases. For all kinds of WIL activities, however, gaps in student knowledge need to be identified prior to the WIL period [9].

Table 1 summarises the critical success factors for short-term WIL identified in prior research and provides an overview of key issues discussed in the literature. These success factors provide a reference point for understanding and interpreting the findings, rather than a predefined analytical framework used to structure data collection.

Table 1. Critical success factors in short-term WIL.

Success factor	Description	Indicative sources
Relationship with companies	Establishing long-term, reciprocal university-industry relationships characterised by clear communication, shared expectations, and mutual benefits. Close cooperation is required in negotiating project assignments, supervision, and evaluation.	[7], [9], [16-18]
Institutional resources and established processes	Availability of institutional resources and coordinated processes to support WIL, including support for students, recruitment and coordination of industry partners and supervisor training.	[3], [9], [16-17]
Project design and alignment with curriculum	Careful planning and delimitation of project scope to ensure feasibility within a short timeframe, alignment with company needs and intended learning outcomes, and integration with parallel courses and programme structures.	[9], [17]

3. Case Study Set-Up

Building on the theoretical background outlined in Chapter 2, this section describes the set-up of the study. The study follows a qualitative, design-based case study approach [20,21], where the structure of the case and evaluation approach were informed by insights from previous research. The research process was iterative and exploratory, aiming both to develop a short-term WIL process in engineering education and to evaluate its implementation in practice. Table 2 shows the five steps in which the study was conducted. Results of the study are presented in Chapter 4.

Table 2. The five-step method used in the study.

Step	Description
Step 1	Analysis of previous research on WIL to identify different WIL formats and critical success factors of short-term WIL
Step 2	Development of a process for short-term, course-based WIL based on literature findings
Step 3	Implementation of the process through a case study
Step 4	Data collection through semi-structured interviews
Step 5	Thematic analysis of the interview responses, to assess the implementation and outcomes of the short-term WIL process, identify results, and inform conclusions and suggested improvements

3.1 Step 1 – Analysis of Prevous Research

The first step of the study was to conduct a literature review to establish the current knowledge base on WIL in engineering education, where the purpose was to identify recent and relevant research that could inform the development of a process for short-term WIL. The literature review was primarily conducted using the Scopus database, which served as the main source for identifying peer-reviewed research on WIL. In addition, relevant literature was identified through backward reference searching of articles and targeted searches to ensure coverage of frequently cited works in the field. Publications were identified using combinations of search terms, including "work-integrated learning," "engineering education," "cooperative education," "internship," "apprenticeship," "project-based learning," "intensive WIL," "short-term WIL", and "micro-internship".

The focus was on peer-reviewed journal articles published primarily during the past five years, though earlier sources were included when they represented important contributions. Only studies concerning higher education were used, and within an engineering context when possible. The reviewed literature served a dual purpose in the study: first, to inform the development of the short-term WIL process implemented in the case study, and second, to identify critical success factors that provided a conceptual background for interpreting and discussing the findings. The literature review was conducted as a narrative synthesis, in which findings from individual studies were compared and integrated thematically [22]. This approach enabled the identification of different forms of WIL, as well as reoccurring benefits, challenges, and critical success factors.

3.2 Step 2 – Development of a Course-Based Work-Integrated Learning Process

Drawing on the literature study, and explicitly informed by the critical success factors for short-term WIL identified in previous literature, a short-term, course-based WIL process was developed for integration into an existing third-year lean manufacturing course in a bachelor of manufacturing engineering programme at a university in Sweden. In particular, the process design was guided by success factors related to establishing and maintaining relationships with companies, ensuring sufficient institutional resources, aligning project design with course learning outcomes and company expectations, and providing structured supervision, preparation, and follow-ups throughout the WIL period.

In addition to the identified success factors, the process was inspired by the 18-step micro internship process proposed by Green and Akella [16], which informed the overall structuring of activities before, during, and after the WIL project. While the 18-step model process was not fully adopted, its emphasis on early preparation, frequent communication, and post-project reflection was adapted to fit a short-term, course-based WIL context. The process aimed to maintain authenticity of workplace learning while addressing common barriers to WIL, such as time and resource constraints. To operationalise the identified success factors within these constraints, the process was structured around three pillars: 1) communication and preparation between universities and companies, 2) frequent, structured supervision with reflection activities, and 3) flexible assignment design that could be adapted to company contexts while still meeting course learning outcomes.

3.3 Step 3 – Implementation of the Process

The process was piloted in as a single-case study with embedded subcases [21], where the overall case was the WIL process implementation, and the subcases consisted of the different participating companies. The selected case was appropriate for the aims of this study as it constituted a deliberate implementation of short-term, course-based WIL within an engineering

programme, directly addressing challenges identified in prior WIL research, such as limited placement duration, alignment between academic and workplace expectations, and the need for structured supervision and follow-ups. The case provided an opportunity to study how these challenges were managed within the constraints of a single course, making it particularly suitable for examining process-related success factors rather than long-term outcomes. Furthermore, the case involved multiple students and external companies, enabling comparison across different organisational contexts while maintaining a shared course structure. At the same time, the case has built-in limitations. It was situated within a single institution and discipline, and the short-term nature of the WIL activity restricted the ability to study longer-term learning trajectories or sustained organisational impact. These conditions should be considered when interpreting the findings and assessing their transferability to other settings.

The study was conducted as a small-scale study, reflecting the limited number of students enrolled in the course during the study period. This scope emphasises examination of a bounded context, rather than statistical generalisation. Students were engaged in a six-week placement, spending one to two days per week on-site. All students received the same general assignment, where they had to do detailed mapping of a manufacturing process at the host company, applying production engineering methods and tools such as time studies, 5S, line balancing, standardisation, continuous improvement, etc. This mapping subsequently served as the foundation for the student's proposed improvements. Upon completion of the project, students were required to produce a written report, which was assessed according to grading criteria provided prior to the start of the course. The course and the course assignment were considered appropriate for the WIL project as most manufacturing companies in the region already used the methods and tools from the assignment; furthermore, no specific technical equipment or specialised manufacturing processes were required for the participation of the companies. Five students attended the course, and were placed in three manufacturing companies. Table 3 describes the companies' sizes (according to the definition from the European Union) and sectors within the manufacturing industry. The companies agreed to pay the students 1500 SEK each upon completion of the assignment, as previous research show that paid WIL activities can improve employability [23].

Table 3. Details of the participating companies.

Company	Size	Sector	No of students
Company 1	Large (multinational)	Engine manufacturing	2
Company 2	Large	Food manufacturing	2
Company 3	Medium	Machinery manufacturing	1

3.4 Step 4 – Data Collection

Semi-structured interviews were chosen as the primary data collection method in order to evaluate the process, targeting both students and company supervisors. This format provided a balance between comparability and flexibility; a consistent set of guiding questions ensured that positive aspects, challenges, and recommendations were addressed across participants, while allowing interviewees to elaborate on issues particularly important to their experience [20].

While the literature-informed success factors guided the development of the WIL process, interview questions were open-ended and did not explicitly probe individual success factors. The fixed set of open-ended questions related to the following topics: overall view of the project, communication and planning, the course assignment, positive aspects and challenges, and recommendations. By using the same questions for all of the interviews, a comparative analysis of the responses was made possible.

Participation in the study was voluntary, and all participants provided informed consent. Including all participating students and supervisors enabled the capture of multiple perspectives, facilitating a more comprehensive evaluation of the WIL process. Group interviews were conducted in cases where joint participation was feasible, as this allowed shared reflection on the WIL experience. For Company 2 and Company 3, interviews were therefore conducted in groups. Individual interviews were conducted when joint interviews were not feasible due to scheduling constraints. For Company 1, both students and the supervisor were interviewed individually, and for Company 2, one student was interviewed individually. Table 4 shows the interview settings. Anonymity was assured by removing identifying details of individuals and companies.

Table 4. Interview settings.

Interview	Company	Respondent	Group/individual	Interview length
1	Company 1	Student 1 (female)	Individual	30 minutes
2	Company 1	Student 2 (male)	Individual	30 minutes
3	Company 1	Supervisor 1 (male)	Individual	20 minutes
4	Company 2	Student 3 (male) Supervisor 2 (male) Supervisor 3 (male)	Group	45 minutes
5	Company 2	Student 4 (male)	Individual	30 minutes
6	Company 3	Student 5 (male) Supervisor 4 (male)	Group	30 minutes

3.5 Step 5 – Analysis and Assessment of Case Implementation

The responses were analysed using thematic analysis, following the systematic approach described by Braun and Clarke [24]. The thematic analysis is done in six phases, including familiarising with the data, searching for themes, reviewing, defining and naming themes, before finally producing the report [24]. This approach enabled the identification of patterns across participants and companies. Comparisons between students and supervisors, and between companies, were conducted to examine whether key aspects of the short-term WIL process manifested consistently or varied across different contexts. Patterns could be identified that were either common across all companies or students/supervisors, or unique to specific cases. This analysis enabled an assessment of how the short-term WIL process was implemented in practice and how it was experienced by participants. The defined themes were categorised in positive aspects, challenges, and recommendations.

4. Findings

In this chapter, the findings of the study are presented. In Section 4.1, the course-based WIL process is described, while Section 4.2 presents the thematic analysis of the interview responses. The themes in the analysis are interpreted in relation to the critical success factors outlined in Chapter 2.

4.1 The Course-Based Work-Integrated Learning Process

Based on the critical success factors for short-term WIL defined in Chapter 3, an iterative, course-based WIL process was developed. The nine-step process, seen in Figure 1, is inspired by the 18-step process for micro-internships described by Green and Akella [16], and focuses on building relationship with companies, communication, supervision and follow-ups, all within a short time frame.

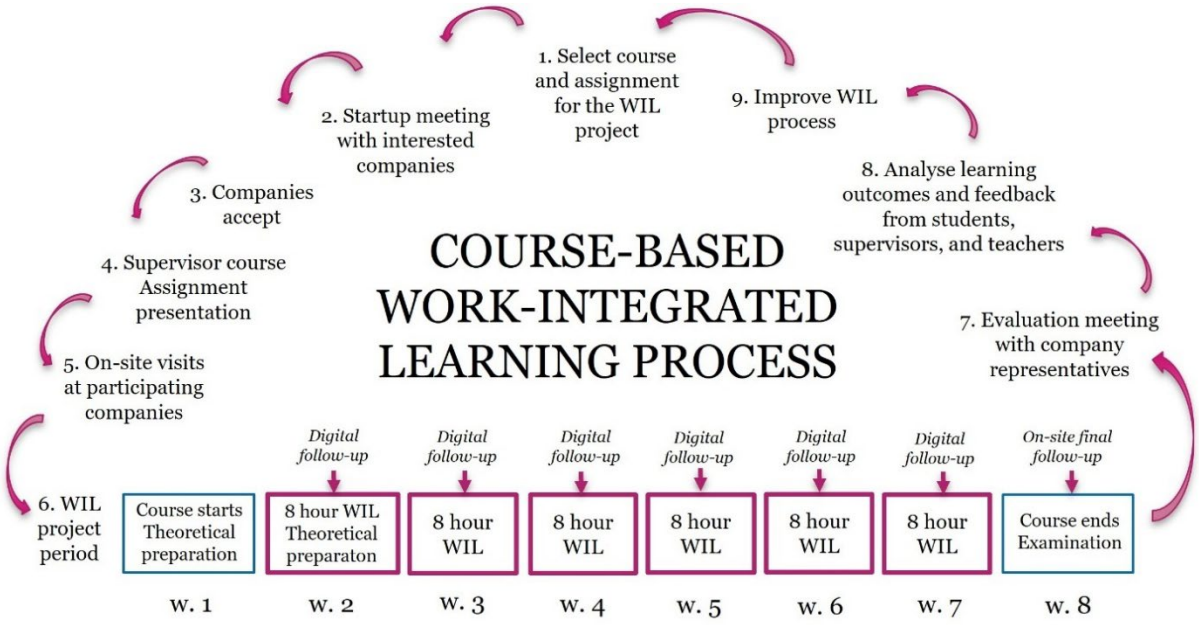

Figure 1. The course-based WIL process.

Step 1 includes the selection of a suitable course and assignment for the WIL project. The assignment needs to be applicable to industry contexts and adjustable to different manufacturing companies. Scheduling also needs to be taken into consideration, as the students might need time for commuting. Once the course and assignment for the WIL project are selected, a start-up meeting with interested companies takes place in Step 2. In Step 3, companies accept and the specific planning phase begins. During Step 4 and 5, the university meets with companies three times prior to the start of the WIL project in order to start building the relationship. In these meetings, details about the assignment and the overall setup are discussed. Also, the company supervisors are given a four-hour supervisor course on campus to be fully prepared for the supervision once the students arrive (Step 4). The university teachers also visit the participating companies on-site before start of the WIL project (Step 5).

Step 6 contains the entire WIL project period. To ensure student preparation, the students participate in learning activities during one week before they start the work at the companies.

The theoretical preparation continues on campus to the second week of the course. When the WIL project is finished, students have one week to prepare the examination before the course ends. During the placement at the companies, the students have weekly three-way follow-ups in the form of digital weekly reports read by supervisors and university teachers. The last weekly follow-up is done on-site with students, supervisors, and university teachers. After the course is finalised, an evaluation meeting with company supervisors occurs, to receive feedback on the process and analyse outcomes together (Steps 7 and 8). Based on the insights and experiences from all of the participants, the process can be improved and applied once again to another, already existing course (Step 9).

4.2 Evaluation of the Process

The analysis of the WIL process across the three participating companies revealed commonalities in perceived benefits and challenges, as well as differences between companies, students, and supervisors. The following sections describe findings from the interview responses in terms of positive aspects, challenges, and recommendations. Table 5 describes the 17 identified themes, which shows how many participants mentioned each theme in their respective interview.

Table 5. Thematic analysis of the interview responses.

Aspect	S1 (C1)	S2 (C1)	SV1 (C1)	S3 (C2)	S4 (C2)	SV2&3 (C2)	S5 (C3)	SV4 (C3)
Positive aspects								
Connecting theory and practice	X[a]	X		X	X		X	
Fresh perspectives and problem-solving			X			X		
Organisational learning						X		X
Professional experience		X	X				X	
Being two students at the company	X	X		X				
Effective company supervision		X		X	X		X	
Project structure		X					X	
Challenges								
Limited time frame	X	X	X	X		X	X	
Insufficient student preparation	X	X						
Lack of student integration		X	X					
Assignment design		X			X	X	X	X
Logistical issues					X			X
Ineffective planning and communication			X		X	X		
High resource demands					X	X		
Recommendations								
Increase student preparation activities	X	X					X	
Delimit assignment/increase time frame	X	X					X	X
Earlier and more frequent communication	X	X	X	X	X	X	X	
Customised assignment					X	X	X	X
Alternate WIL structure			X	X	X	X	X	X

[a] 'X' indicates that a participant mentioned the theme during the interview. This does not reflect strength, frequency, or agreement, and the themes were derived inductively from the interview data.

4.2.1 Positive Aspects

The following section presents participants' positive experiences and explicitly compares perceptions across students and supervisors, as well as across companies, to identify patterns and differences in the short-term WIL process. The main positive aspects mentioned in the interviews were the opportunity to connect theory and practice, the fresh perspectives and solutions that the students provided, the organisational learning, the professional experience, to be more than one student at each company, effective company supervision, and project structure. As seen in Table 5, the majority of the students lifted different positive aspects than the supervisors. Comparing students and supervisors, the two most important positive aspects for students were effective supervision and the opportunity to connect theory and practice. Supervisors did not explicitly mention the connection between theory and practice; this may reflect differences in perspective, as supervisors emphasised other benefits such as organisational learning and fresh perspectives brought by the students. Students at all companies described how the projects allowed them to see the limitations of theory when applied in real-world settings, requiring them to adapt tools and methods to workplace realities. Student 4 stated: "There is a lesson in the fact that theory is not directly transferable; assumptions always have to be made" (translated from Swedish). Students 2, 3, 4 and 5 reported positive experiences with supervisor interaction, noting that the supervisors were accessible and supportive.

Interestingly, three out of the four students who were placed in pairs specifically noted that they found it advantageous not to be placed at the company alone, even if they had individual assignments. They reported that this arrangement allowed for ongoing peer discussion and collaborative problem-solving and interpretation of the assignment throughout the project period. According to student 5, however, being placed at a company alone did not cause any troubles; on the contrary, the arrangement proved beneficial. The student expressed it like this: "It has worked well to work independently; it has fostered self-reliance" (translated from Swedish). From the company supervisor side, a clear benefit was the fresh perspectives students brought. Supervisor 2 at Company 2 said: "It becomes a form of training for us as well. When the students discuss different concepts with our staff, we receive training as a by-product. We also gain new perspectives on the production process, which is valuable" (translated from Swedish). All supervisors from Company 1 and Company 2 described this as a "fresh set of eyes" on the organisation. Supervisors at Company 2 underlined the organisational learning generated by the students' critical reflections and improvement suggestions. This theme of mutual value creation, where students learn from practice while companies gain new insights, was strongly present at Company 2, and to some degree also reflected in Company 1 and Company 3. Supervisor 4 at Company 3 lifted that the broad scope of the project allowed flexibility to address company-specific needs.

4.2.2 Challenges

Challenges are reported below, highlighting both similarities and differences between students and supervisors, as well as between the three companies, to better understand factors influencing the WIL experience. The main challenges experienced by the participants were the limited time frame of the project, insufficient student preparation, lack of student integration in the company, the design of the assignment, logistical issues, late release of information and ineffective planning, and high resource demands. In contrast to the positive aspects, supervisors and students agreed on most of the challenging aspects and lifted the same themes, as can be seen in Table 5. To both students and supervisors, the limited time frame and the design of the assignment were the most commonly experienced challenges. Four out of five students perceived the project as challenging

and complex, and that the limited time frame made the assignment feel disproportionately difficult. Student 1 at Company 1 said: "The project was experienced as difficult and complex – too difficult for the time available. I would have gained a deeper understanding if more time had been allocated (translated from Swedish). Supervisors from Company 2 agreed, as confusion about the assignment and the overall setup resulted in that the students were unable to deliver results on the level that the supervisors initially had expected. This challenge is closely related to the assignment design challenge, where three out of five students and three out of four supervisors expressed that the assignment proved to be too unclear and required a lot of adaptions and delimitations, which in turn affected the students' productivity.

Both students from Company 1 perceived insufficient preparation as a challenge, whereas students from Companies 2 and 3 did not report this issue, highlighting a company-specific difference. Also, student 2 from Company 1 reported limited access to necessary resources, as well as a lack of formal contact and clarity regarding their role and responsibilities. The fact that students from the other companies did not report similar experiences may be related to differences in company size. Company 1 is a multinational organisation, which likely requires students to interact with a larger number of stakeholders and navigate more complex organisational structures than is typically the case in smaller companies. This interpretation is further supported by the fact that both students and the supervisor from Company 1 independently reported that engaging students in the company culture within the limited time frame was challenging, whereas neither students nor supervisors at the smaller companies raised this issue. The supervisor from Company 1 said: "It was difficult to integrate them [the students] into the group of technicians. If they had had full days during the first week, it would have been easier for them to become part of the group. They would probably have learned more that way. As it was, it felt somewhat fragmented" (translated from Swedish).

Differences in commuting experiences were noted across companies, with Company 1 students unaffected, while students at Companies 2 and 3 experienced some logistical challenges. Especially student 4 at Company 2 pointed out that commuting and transportation resulted in a substantial amount of ineffective time. Supervisor 4 at Company 3 also mentioned that commuting could possibly have been a problem, even though it was not an issue for Student 5. Company 2 and 3 both require commuting from campus, which is probably the reason to why students at Company 1 did not experience this. Both students and supervisors at Company 2 noted high resource demands, which is a direct consequence of the high engagement of the supervisors stated in positive aspects.

4.2.3 Recommendations

Participants' recommendations are presented with attention to differences and commonalities across participant roles and companies, illustrating shared priorities and context-specific suggestions for improvement. The main recommendations from the participants were to increase student preparation activities, delimit the assignment or increase the time frame, release information earlier and communicate more frequently, customise the assignment and use another WIL structure. Students and supervisors across all companies were united in their recommendations, as seen in Table 5. The two recommendations that were given by most, both students and supervisors, were earlier and more frequent communication, as well as to use an alternate WIL structure. All students recommended that the university communicated the details of the WIL project earlier to increase preparedness. Student 4 at Company 2 said: "It would have been helpful to receive earlier information that the activity was a placement involving full days, in order to plan for commuting distance (translated from Swedish). Also, the supervisors would have

preferred more and clearer information about the project and the course assignment earlier in the process. Student 5 at Company 3 especially pointed out that more frequent communication is needed between both student, company supervisor, and University teachers. Using another WIL structure was another common recommendation by both students and supervisors. Several suggestions were raised; for example, a full-time trainee period during one to two weeks, or a rotational setup with a practical week at a company every other week and theory in between. Supervisors and students at Company 2 and 3 agreed on that another, more concentrated WIL structure would have been interesting to explore. They also lifted that a more customised assignment, instead of a general one, would have been more beneficial.

5. Discussion

This chapter discusses the findings in relation to prior research on Work-Integrated Learning (WIL) (Section 5.1), and reflects on methodological considerations and limitations relevant to the interpretation of the results (Section 5.2).

5.1 Interpretation of Findings in Relation to Prior Research

The short-term WIL process developed was based on several critical success factors identified in the literature, and several of the themes identified in the interview responses align with the success factors summarised in Table 1, particularly those related to supervision, project alignment, and communication. Effective communication between universities, supervisors, and students proved to be central, which is consistent with prior research. The presence of structured supervision and short feedback loops contributed to positive student outcomes, and companies reported positive effects of the short-term placement structure. At the same time, the findings indicate that several challenges previously identified in WIL research remain relevant in short-term, course-based placements. Ensuring that companies have the resources, understanding, and motivation to host students is critical. The short-term format may lower barriers for participation, but it still demands careful project alignment and coordination to ensure meaningful outcomes within the condensed timeframe. The interviews extend prior work by showing that, in short-term WIL, student assignments need to be customised to company needs beforehand to ensure student effectiveness and company satisfaction. This suggests that generic assignments are less effective in short-term WIL, as they require substantial adaption by students and supervisors, potentially reducing the learning benefits.

One critical factor that has received comparatively less attention in prior research on success factors of short-term WIL is the role of logistical considerations. Findings from this study indicate that when a WIL project spans only a few weeks, ensuring that commuting between company and campus is feasible for students becomes particularly important. In contrast, several outcomes identified in this study align with earlier research on critical success factors of short-term WIL, including findings indicating that the short-term WIL process delivers clear benefits for students, particularly in strengthening the connection between theory and practice, raising awareness of knowledge gaps, and initiating reflection. For companies, the process provided organisational learning opportunities by bringing in students' "fresh eyes". Supervisors also valued the discussions with students about tools and methods, framing the collaboration as mutually beneficial. These results align with prior WIL partnership research highlighting reciprocity and shared value.

5.2 Methodological Considerations and Limitations

The research design, combining a narrative literature review with a case study, enabled both the identification of critical success factors and their practical testing. However, as a small-scale, single-case study, the findings are context-dependent and may not be generalisable. In addition, the case was situated within a single engineering course at one institution, with participating companies recruited through existing networks. This context may have influenced both implementation and outcomes, as companies willing to engage in WIL may already hold positive views of university-industry collaboration. Another factor that may have influenced the findings is that some interviews were done in groups, with students and company supervisors present together, potentially shaping responses. Future studies incorporating surveys and larger participant numbers could strengthen the evidence base and test the transferability of these findings across courses and institutions.

The thematic analysis focused on identifying overarching patterns across student and company experiences, rather than exploring individual trajectories in depth. While this approach enables cross-case comparison, it may have obscured more nuanced differences in how short-term WIL was experienced by individual participants. The thematic analysis was based on open-ended interview questions that invited participants to describe their experiences in their own terms (perceived positive aspects, challenges, and recommendations). This approach enabled the identification of a broad set of themes grounded in participant perspectives, rather than structuring the analysis directly around predefined success factors from the literature. While this strategy provided insights into short-term WIL experiences, it also means that the resulting themes do not map one-to-one onto existing theoretical frameworks. As a result, connections to previously identified critical success factors were made interpretively in the discussion, rather than being explicitly elicited through the interview guide.

6. Conclusions and Future Work

This study set out to develop and examine a structured process for short-term, course-based work-integrated learning (WIL) in engineering education. The study contributes to the literature on WIL by providing a case-based analysis of short-term, course-based WIL in engineering education, highlighting how established success factors manifest in a compressed time frame. For educators and programme designers, these findings offer practice-oriented insights into structuring, coordinating, and supporting short-term WIL within existing engineering courses. From the student perspective, the short-term WIL process strengthened the connection between theory and practice. The collaboration with companies enabled students to gain insights into professional engineering practice within the scope of a single course. For companies, the presence of students offered fresh perspectives, opportunities for organisational learning, problem identification, and strengthened university-company collaboration. Together, these findings illustrate the potential of course-based WIL to support student learning and industry engagement.

The findings of the study highlight several conditions critical for success. Active supervision and structured support, including frequent follow-ups, proved central to positive student learning outcomes. At the same time, the study highlights ongoing challenges related to aligning project scope, expectations, and time constraints in short-term WIL formats. Addressing these challenges will be key for the sustainability of short-term WIL processes. Although based on a limited case, the study provides insights that can inform future implementations and research. Building on the recommendations provided by the participating students and companies, the course-based WIL

process should be improved with a customised assignment, a more concentrated WIL project period, and increased company-university preparation and communication. Future research may also expand the application of short-term WIL models to other courses, larger student groups, and additional organisational contexts, such as the inclusion of international students. Conclusively, this study highlights how short-term WIL can be developed and integrated into engineering courses, while underscoring the importance of structure, coordination, and alignment for sustainable implementation.

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