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FOSTERING MEANINGFUL RELATIONSHIPS: MANAGING ACADEMIA AND INDUSTRY INTERACTIONS IN PROJECT-BASED LEARNING

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ABSTRACT
Academia-industry collaboration in product development and innovation fosters significant enhancements in project-based learning (PjBL). PjBL, recognised for integrating acquired knowledge into real-life projects, benefits from active industry involvement by providing academia with contemporary industry challenges, connecting to prevailing market trends and impactful course outputs. This symbiotic relationship bridges the gap between theoretical knowledge and practical application, providing students with relevant industry exposure while granting industry access to innovative minds shaping its future. However, to harness the full potential of this synergy, efficient management of these relationships is crucial, involving complexities such as mutual benefits, intellectual property issues, time commitments, and role clarity. Based on interviews with 54 educators from 33 global institutions within the Design Factory Global Network (DFGN), this qualitative study explores four key activities of academia-industry relationship management: expectation management, ongoing communication, network building, and value-adding events. Effective expectation management clarifies mutual benefits early, while regular communication aligns academic and industry objectives. Building robust networks and hosting value-adding events strengthen these partnerships, contributing to sustained growth and innovation across educational and industry spheres. Through the key criteria revealed in these activities, the study provides insights into forming and maintaining effective industry relationships, enhancing project-based learning, and contributing to broader innovation progression.

Keywords: Project-based learning, collaboration, stakeholder management, industry interaction

1 INTRODUCTION
In today's fast-paced product development and innovation environment, forging strong bonds between academia and industry can support innovation efficiency [1]. The collaboration between industry and academia can take several forms, including research and curricular collaborations [2]. Project-based learning (PjBL) is one form of curricular collaboration that has become increasingly prominent in education. This collaboration facilitates the integration of theoretical knowledge into practical scenarios and ensures that academic curricula remain attuned to current market and industry needs. The benefits from the student side are clear, with PjBL positively affecting students' self-efficacy and learning achievements compared to traditional teaching and learning methods [3]. Their teamwork and communication skills are often enhanced through interdisciplinary collaboration, while the gap between theory and practice is bridged when students get to solve industry problems [4]. Close collaboration with a company can also enhance student motivation and increase the possibility of students applying the work-life skills needed after graduation and during their studies [5]. For industry, collaboration with academia can positively affect the company's R&D functions, as collaboration facilitates enhanced problem-solving capabilities by developing mutually beneficial practices [1].
However, creating and maintaining the university-industry partnerships required for such mutual learning can be challenging; differences in knowledge, skills, and institutional cultures may negatively impact knowledge transfer [6]. The symbiotic relationship between academia and industry requires careful navigation of various complexities, including intellectual property issues, time allocation, mutual benefit clarification, and role clarity [7]. As such, stakeholder relationship management emerges as a

vital element in this context, ensuring that the potential of such collaborations is fully realised [8]. This paper delves into the experiences of educators within the Design Factory Global Network (DFGN)[1], a consortium connecting higher education and research institutes across Europe, Asia, Australasia, and the Americas. It aims to shed light on the relationship management strategies that lead to successful academia-industry partnerships, focusing on expectation management, ongoing communication, network building, and value-adding events. Through this exploration, the study provides actionable insights for educational institutions seeking to enhance their collaborative efforts with industry.

2 LITERATURE REVIEW

Organising university-industry collaboration around programmes or courses where student teams work on an industry challenge is a common practice today that helps ensure that education outcomes match industry needs [9]. Early studies focused on the risk associated with university-industry collaboration as the desire for publicly shareable knowledge would be impacted by the need to protect proprietary information [10]. More recent studies have identified facilitation, time, and culture as barriers and enablers for university-industry collaboration [7] while highlighting the potential risk should a conflict of interest arise [10]. Managing the university-industry collaboration is critical as it can benefit all involved parties but also requires many forms of support to succeed [11]. First, effective communication between the involved parties - students, faculty, and firm partners - is essential for the collaboration to be successful [12]. Educators should clearly understand the learning objectives, teaching methods, and reasons for using a challenge or problem-based approach [13]. In addition, they should consider how learning is assessed, the involved partners' and teachers' roles, and how complex the presented problem is [13]. Policies and existing relationships may have a supporting role in managing university-industry collaboration. Still, it seems that resources are a critical factor that can surpass the other supporting factors [14].

On the industry side, in turn, active internal facilitation in the firms and long-term approaches to cooperation between university and industry can help foster bi-directional learning, help close organisational gaps potentially hindering collaboration [15], and even mould the universities and organisation's culture [14], and strengthen further cooperation. Indeed, prior experience is one of the strongest predictors or supporters of collaboration, as trust, connections, and shared practices drive collaboration to take root in organisations [14].

While there is literature on the benefits, barriers, and enablers of university-industry collaboration, research on managing PjBL is often focused on learning activities. To further leverage academia and industry collaboration in PjBL, the current study aims to identify how educators manage these relationships.

3 RESEARCH DESIGN

This original qualitative study, from which the insights presented in this paper emerged, aimed to explore project- and problem-based learning dynamics.

3.1 Data Collection

Data were collected through one-hour interviews with 54 educators from various institutions globally (P1 - P54) as a part of a larger research project, Educating for Innovation. The educators interviewed were affiliated with 33 different Design Factories, part of a more extensive network spanning multiple continents. Interviewees mainly worked as directors, professors, or lecturers in their institutions and came from diverse disciplinary backgrounds and multidisciplinary combinations. The interviews delved into the diverse practices employed in problem-, design-, and project-based learning within their respective institutions. The interview questions were open-ended to facilitate a comprehensive understanding of these practices. This approach allowed the educators to freely share their insights, experiences, and interpretations, leading to a richer and more nuanced dataset. Following the interviews, the audio recordings were professionally transcribed to ensure the accuracy and completeness of the data. These transcriptions served as the primary material for subsequent analysis.

[1] Design Factory Global Network (https://dfgn.org/)

3.2 Data Analysis

Thematic Analysis was used to identify patterns (themes) within the interview data [16]. This process involves several stages, including familiarising the data, coding, searching for themes, reviewing, defining, and naming themes [16]. The analysis began with thoroughly reading the transcriptions to familiarise the researchers with the content. Coding was performed to highlight significant pieces of information on supporting PjBL across the interviews. Subsequent phases involved grouping these codes into potential themes based on thematic similarity and then reviewing and refining these to ensure they accurately reflected the data. Four main categories of activities were identified: expectation management, ongoing communication, network building, and value-adding events. During the final analysis phase, ongoing communication and network building were both identified as prominent during the entire project life cycle. This enabled the four themes to be grouped into three strategy phases concerning PjBL (see Figure 1).

4 FINDINGS

The interviews revealed different strategies and challenges in relationship management in PjBL from the educators' perspectives, linking to different phases of the courses and relationships (Figure 1).

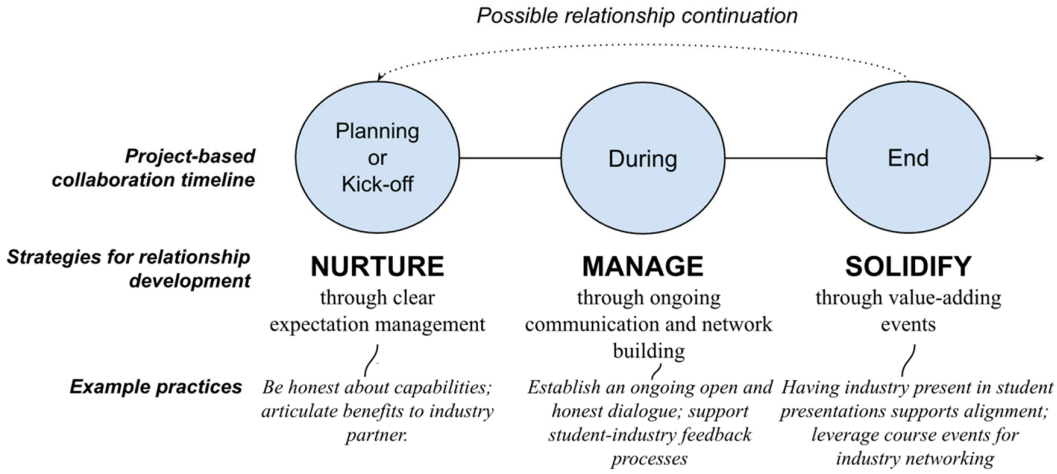

Figure 1. Strategies for meaningful industry-academia PjBL relationships

4.1 Nurture relationships early in the academia-industry collaboration through expectation management

One of the foremost challenges identified in the interviews was the necessity of managing expectations and establishing transparent relationships with industry partners from the onset of the collaboration. For example, P23 noted that a major difficulty lies in "finding a common point… between the solution, the value that you want to create with your solution, and the value, of course, for the client". Misalignment between academic goals and industry expectations frequently emerged as a critical friction point. Such discrepancies can hinder the smooth execution of collaborative projects, potentially compromising the mutually beneficial outcomes intended by these partnerships. Thus, early and continuous engagement in expectation management is paramount to mitigate misunderstandings and foster a productive, harmonious alliance between academic institutions and industry stakeholders. P44 emphasised the importance of being "honest and transparent about the strengths and capabilities we have and what we don't," highlighting that unrealistic expectations can lead to oversized workloads and unmet commitments. This is essential as P11 shared that the teaching team may often "only have a small number of hours" dedicated to a course.

The primary strategy for such expectation management was clearly articulating collaboration's benefits to industry partners, paving the way for a more cohesive and productive partnership. For some educators, initiating this discussion early in the collaboration process set the foundation for a productive relationship and aided in managing expectations (P10 and P16), for others, expectations were managed through formal contact with the industry partner (P19) or by only collaborating with innovation focused partners as they understand the development process (P38). P26 and P36 highlighted that hosting an

event or workshop for industry partners to introduce the ideas, tools, and processes that student groups would engage with before the project starts helps them understand what they could expect from students. One frequently communicated benefit was that by involving students in projects, companies gain exposure to fresh perspectives that can ignite innovations as students, unencumbered by existing industry paradigms, often approach problems with unique and creative solutions. For example, P27 explained that working with students provides "more insight in new visions, new materials, new processes," and while the course outcome prototypes may not meet industry standards, they "broaden new ideas inside of the company." Similarly, many educators shared that industry partners may benefit from collaborating with students as a youthful demographic. P39 highlighted that companies are interested in student projects to gain insights into "what the current generation [is] looking for," recognising that while the outputs may not be polished, they provide valuable new perspectives.

Several educators also noted that engaging with students offers a cost-effective method for companies to explore new ideas and tackle problems, especially those that are more speculative or "blue sky." While in-house research and development efforts may focus on more immediate and tangible projects, a few educators shared that industries' collaboration with students provides an opportunity to investigate these high-risk, high-reward areas without significant financial investment. For example, P54 emphasised that companies often lack "the resources or someone who could elaborate this further," and student projects provide a valuable means to explore ideas that might otherwise be overlooked due to resource constraints. A notable challenge for many educators was the potential limitation in flexibility associated with industry projects, as their specific goals and deliverables may sometimes restrict students' creative freedom, possibly stifling the very innovation they seek to harness.

A final cluster of benefits of PjBL for industry identified by educators was that it could serve as a conduit for companies to identify and connect with potential future hires. These engagements allow companies to observe students' problem-solving abilities and fit within the corporate culture. P40 noted that industry partners engage in these collaborations to "always look for new ideas" while also seeking "new human resources," making it both an innovation driver and a recruitment opportunity.

4.2 Manage academia-industry relationships through communication and network-building

Most educators shared that maintaining consistent communication with partners is crucial throughout the project. "Communication is a vital thing during the whole process. Not only inside the team, or here at the university, but also with the other stakeholders, enterprises or different organisations." (P44). Participants highlighted regular meetings and well-defined frameworks as essential for ensuring all parties remain aligned with the project's goals and progress. Ongoing communication and regular interaction were the needs most noted during interviews.

Honest communication and feedback, while invaluable, could sometimes lead to challenges during the courses. P46 highlighted that industry partners "are not used to… giving feedback in an academic way". Even though direct industry feedback may be relevant, a few educators noted that it can be perceived as harsh by students, necessitating a supportive environment where students are equipped with the skills to interpret and learn from this feedback effectively. Many educators shared that establishing an open and honest dialogue helps students appreciate real-world expectations and professional standards in industry settings and that "...if you find the right people within the business, it's an easy conversation." (P34).

Several educators shared another key strategy for successful industry-academia collaboration: building and nurturing strong networks. P38 said they "love to continue working with the same companies and stakeholders to build a relationship with them." Professional networks offered valuable opportunities for maintaining these partnerships. Some educators noted that academic institutions and industry partners can foster ongoing relationships beyond individual projects by engaging in these platforms and thus "bring the companies closer to the university" (P3).

4.3 Solidify academia-industry relationships through value-adding events

Several educators highlighted the opportunity to leverage interactive events as the collaboration draws closer to celebrate the partnership's achievements and further bolster the relationship. Many educators identified events such as final presentations and networking galas as platforms to showcase student work and the creative process championed by educators. Such events allow the broader industry group to "...see prototypes and get to understand the way we do things" (P43), engaging not only with current industry collaborators but potential ones as well as they were able to "...network with other partners,

with other companies (P40). P30 highlighted the importance of continuous involvement, emphasising that industry being present during the final presentation, where students "show the results" and demonstrate their work "with the partner there in the classroom", ensures meaningful collaboration and alignment. P28 reinforced the role of presentations in maintaining industry engagement throughout the term, explaining that "we have at least three presentations, which are open to critiques, and they have to be here with us". These recurring presentations provide structured moments for interaction, allowing industry partners to actively follow project progress and contribute to the learning progress, further strengthening the collaboration.

Networking galas, in particular, were noted by several educators as a practical, informal setting for dialogue, where meaningful connections can be made and discussions about future collaborations can be initiated. P42 noted that these events are also an opportunity to engage potential new stakeholders, as "we invited other people who are not involved yet" to experience the student results and understand the process. Leveraging events as opportunities for industry networking also allows educators to understand the ecosystems that develop around complex, real-world challenges. P14 noted, "…there are several ecosystems of partners that each have their own challenge, but there's some kind of connection between them, so when the sponsors come to see the project final galas or whatever events we have, then they also learn from each other and their ecosystem partners" Finally, several educators shared that by creating a space where achievements are acknowledged and novel ideas celebrated, academia and industry bond can be strengthened.

5 DISCUSSION AND CONCLUSION

While separate streams of research have developed to study problem-based learning (PBL), project-based learning (PjBL), the differences and similarities are often subtle [13] and depend on the application case [17]. Therefore, while this study focuses on understanding the dynamics of academia and industry interactions in the context of PjBL, the findings may also be relevant to PBL.

By clearly defining the benefits of collaboration with academic institutions, educators may secure greater industry participation in project-based learning (PjBL). Engaging with students provides a cost-effective method for exploring speculative or high-risk, high-reward projects without significant financial investment. Even though research has shown that PjBL can result in unique and creative solutions to industry challenges [18], educators should balance the promise of novel ideas from students with the reality of the course structure and learning outcomes. Educators saw clear communication of the learning outcomes, with an open discussion on possible project parameters early in the process, as helpful. This also helps align academic and industry expectations and contributes to all stakeholders' commitment [19]. Additionally, industry partners can identify potential future hires during the project and gain an understanding of the younger generation's aspirations. In contrast, students understand the industry landscape and build meaningful professional connections.

Constraints noted by some educators, such as limited teaching hours in a course and funding, necessitate educators to strategically leverage existing course activities and networks to foster industry partnerships during project-based learning. This study explores several actionable insights for educators, such as leveraging university networks as a valuable resource through which industry collaborators can "share knowledge and generate innovations effectively and efficiently" [20]. Rather than expending valuable resources to initiate new collaborations or events, educators can optimise outcomes by integrating industry engagement into pre-existing curricular or extracurricular frameworks and events such as presentations or end-of-project galas. These events provide a platform to showcase student work, leverage relevant networks, and discuss future collaborative opportunities. They allow academia and industry to "tap into complementary skills of each other and thus potentially help with saving cost and enhancing research outcomes." [21] Networking across academic and industry groups also allows students to gain insights into industry expectations. Although further research is needed to understand the long-term development of industry-academia partnerships, as well as the broader impact of structured engagement strategies, the current findings emphasise that expectation management and leveraging of course activities, such as interim presentations and networking events, can play a role in fostering stronger relationships and enhancing the effectiveness of project-based learning.

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