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Best Practices for Industry Liaisons in Engineering Design Projects: Insights from Students and Liaisons

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Abstract

Many engineering programs provide opportunities for students to work on design teams for projects that are industry sponsored, such as in capstone courses. In these experiences, the collaboration between student teams and industry liaisons can be crucial for the successful project completion. The end goal of this study is to contribute to a deeper understanding of how the role of the liaison contributes towards a successful project delivery and a fulfilling educational experience for both the students and the liaison. This paper presents a comprehensive set of guidelines to ensure a positive and productive experience for the students and liaisons. These guidelines are produced through the collection and analysis of insights into proven practices that contribute to the success of these collaborations. This paper describes a three-phase methodology for collecting the insights through 1) a literature survey of industry sponsored engineering courses, 2) interviews and surveys conducted with experienced industry liaisons, and 3), student evaluations from two capstone courses from two institutions. Students have diverse expectations for their liaisons including their consistent availability, honesty, and encouraging support. The findings suggest a positive correlation between students' satisfaction with the project experience and their satisfaction working with their liaison. However, even with the best intentions, meeting these demands can be challenging to liaisons without proper training or experience. Project liaisons can also contribute to their own professional development and advance their lifelong learning skills. This paper provides suggestions for the course faculty to facilitate these guidelines and help prepare the industry liaisons for their role.

Introduction

Many engineering programs provide opportunities for students to work on design teams for projects that are industry sponsored, such as in capstone courses [1]. Sponsoring industries might assign employees to serve in some capacity as the project liaison and to ensure project deliverables meet expectations. The course faculty might enlist the liaison to also help with student development and the evaluation of students' work.

Working in teams is also an expected student outcome for all engineering programs and it relates to skills sought out by engineering employers [2]-[3]. Successful engineering students must function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives [4]. Therefore, student success in these courses is determined through the quality of their project deliverables, the quality of their individual contributions, their effort towards the collaboration experience, and their professional skills such as teamwork and communication. The sponsor liaison would help prepare the students to become successful team members and proficient in developing project solutions; however, are the liaisons adequately prepared for this role?

This paper provides a summary of the literature on the role and performance of project liaisons for engineering capstone courses, collects student data from two capstone courses from two institutions, and collects data from current liaisons, with the goal of outlining a set of guidelines

to help prepare liaisons for their role. The results of this study should assist liaisons in three key areas, namely, contributing to a rewarding professional development experience for the students, ensuring successful project completion, and enhancing their own professional and personal growth.

Research Questions

This objective of this study is to examine the experience of students and liaisons to help understand how the role of the liaison contributes towards a successful project delivery and a fulfilling educational experience for both the students and the liaison. This objective is assessed through the following research questions.

a. Are project liaisons critical for the success of student teams delivering successful projects?
b. Do students appreciate liaisons who are deeply invested in their work?
c. Are engineers prepared for the liaison role?
d. Do engineers benefit from the project liaison experience?
e. Do engineers enjoy the project liaison experience?
f. What actions or approaches can liaisons take to improve the project experience?

Through exploring these questions, the authors identified a collection of best practices that industry liaisons can employ to provide the students and themselves a successful and enriching experience.

Literature Review

Multiple studies have assessed the working relationship of faculty and industry liaisons to determine how to provide a successful experience for everyone involved. These studies have looked at this challenge from the perspective of the faculty, the students, the sponsoring organization and the liaisons, and the results have been congruent. The review in this paper will focus on the experience of the liaison as a person, rather than the sponsoring organization.

A publication from 2007 shared perceptions and experiences of six industry liaisons from their vertically integrated courses in biosystems engineering design [5]. Their key findings included benefits sought by the liaisons, areas of weakness in their experience and recommendations to enhance the experience. The benefits liaisons sought included improved project deliverables and helping students. Areas of weakness included understanding the course design process and their role within the process. Their liaisons described that to provide a successful experience to the students, it was important to build a working relationship with the students with clear expectations established from the beginning.

The benefits listed above show an interest in obtaining useful work products from the student team, which helps the sponsoring organization, and in contributing to engineering education, which again can benefit the sponsor but can also provide a sense of fulfillment for the liaison. A 2014 publication from a public university in Navarra, Spain, shared some of the identified benefits of their recent university-industry initiatives for their multiple engineering programs. Liaisons appreciated the opportunity for recruiting students, collaborating with faculty and the lifelong learning experiences [6]. A 2017 publication portrays an industrial sponsor who had

sponsored several large-scale capstone design projects and their perspective on working with students on these projects [7]. The sponsor described how their projects were used to introduce new concepts and responsibilities to existing employees in the form of supervisory skills as well as overall project planning and execution. Summarizing the above, a project liaison can potentially obtain personal and professional benefits such as contributing to engineering education, collaborating with faculty, and professional development in the areas of engineering and project management.

As academic programs with industry collaborations strive to provide all stakeholders with an optimized experience, the areas of weakness described above have been identified in multiple studies. Most notably, a publication from 2009 shared a *how-to* guide for liaison engineers in capstone courses [8]. To assist liaisons, this guide includes a list of the expectations the course has from them, lists of *what to do* and *what not to do*, and documentation to help the onboarding process with the faculty. These lists include topics such as how to motivate the students, how to manage conflicts, how to provide support to the teams, and how to collaborate with the course faculty. Subsequent studies have also described how to help liaisons contribute to a successful project experience.

A 2014 publication about an industry-sponsored biomedical engineering capstone course describes how sponsors need to understand their roles in the project, be available to students for guidance and resources, be aware of required time commitments, and set clear expectations for their availability and interactions [9]. Similarly, another 2014 publication on how to create a culture of communication between industry sponsors and student teams, describes the importance of establishing guidelines at the beginning of the project for both the students and industry sponsors [10]. The authors describe that when the industry sponsor does not have enough time to communicate regularly and give needed feedback, the students become discouraged thus hurting the project outcomes. They also identified that expecting liaisons to contribute with the project evaluation can be challenging without appropriate guidelines.

Congruent to those challenges, a study published in 2021 used interviews with representatives from some of their capstone industry sponsors to determine their motivations and perceptions of the benefits from the collaborations [11]. Their findings suggest that the company sponsor-team relationship and dedicated time is directly related to the success of the project, that is, liaison interactions and project support are critical for student motivation. One of their respondents explicitly stated that “What we have found with [the] previous ten projects is that, the more involved we are, the better the output.”

The studies described above show the critical responsibility of the project liaison with respect to the project outcomes and hence the importance of helping them prepare for this role. Moreover, liaisons must also consider their inherent responsibility as career role models for the students. Given that not many students have the goal of a career in academia, liaisons must be mindful that they represent the professional life to which many students aspire. As role models, students will closely observe the care liaisons put into projects and likely mirror their effort. For example, a study from the 2012 Capstone Design Conference had two panels of students from multiple universities who had recently concluded their industry-sponsored capstone course [12]. These

panelists concluded that students tend to do just the amount of documentation expected by industry: if their sponsor expected less, the team did less. The panelists also described how liaisons "strongly motivate the student group" and how they can be disappointed when the liaisons do not provide the expected support, such as not having the resources they seek or not providing the availability they expected.

These concerns show the importance of liaisons setting clear expectations from the beginning and the burden of responsibility that comes with accepting the role. Therefore, it is essential that sponsoring organizations appoint liaisons that are enthusiastic about the role, with access to the knowledge and resources needed for the project and provided adequate time to fulfill the expectations. Likewise, while the studies above identified the importance of faculty properly guiding liaisons before and during the experience, given the critical role liaisons play, faculty should also support them in realizing the personal and professional value they can obtain from the experience. When individual growth is prioritized, the project's success is amplified.

Methodology

An exploratory qualitative study was developed to collect data from the students and the liaisons. Data from the students was obtained through course evaluation surveys that students were required to submit during their course year. Though mandatory, students were only graded for turning them in regardless of content. Students completed four iterations of the surveys over the year and by the last one at the end of the year, most were convinced to be open and honest. Data for this study was only collected from the last survey of the year. The surveys did not include explicit prompts about the sponsors or liaisons, nonetheless, several students provided positive and negative comments regarding their experience with their liaisons.

Data from liaisons was collected through either an interview or a survey, both of which had the same questions. The surveys were shared through a Qualtrics link, where respondents had to acknowledge their voluntary participation. Both data collection instruments begin with questions related to their identity, followed by 1) questions related to their experience as liaisons, 2) questions about their evaluations of their experiences, and 3) questions regarding their advocacy for future liaison opportunities.

Data Collection

This paper includes data obtained from two large public institutions in the Southeast region of the United States, herein referred to as institutions Blue and Orange respectively, through their multidisciplinary two-semester engineering capstone course sequences. Students must apply to these courses and their participation accounts for their major's senior design course. In these courses, student teams design and develop a solution to a problem defined by their unique industry sponsor. In addition to financial support, each sponsor designates an employee as the project liaison who is responsible for continuously meeting with the team to provide engineering guidance and support with respect to the deliverables.

The methodology for this study was reviewed by the respective Institutional Review Boards prior to data collection; however, only the Blue institution's IRB approval was received by the time of this publication.

Table 1 lists the student data collected from each institution.

Table 1. Overview of the Courses from which Student Data was Collected for each Institution

Institution	Academic Years	Total Enrolled	Disciplines (ordered by frequency)
Blue	Five: Fall 2019 through Spring 2024	356 students (30% female, 70% male)	Computer Science, Engineering (mechanical, electrical, computer, chemical, biomedical, aerospace, biological, material science, industrial, civil, environmental)
Orange	Five: Fall 2019 through Spring 2024	216 students (28% female, 72% male)	Mechanical Engineering, Computer Science, Engineering (Electrical, Biomedical, Industrial, Computer), Finance, Supply Chain Management, Business Analytics, Aerospace Engineering, Chemical Engineering, Accounting, Civil Engineering, Economics, Nuclear Engineering, Marketing, Management, Biosystems Engineering, Mathematics, Modern Foreign Lang/Literature, Statistics

Table 2 lists the liaison data collected, which was collected in fall 2024. The liaison respondents include males and females, and represent micro, medium and large-size businesses.

Table 2. Liaison Data Collected from each Institution

Institution	Number of Liaisons	Number of Projects Served as Liaison	Collection Method
Blue	5	{2, 3, 6, 7, 8}	3 surveys, 2 interviews
Orange	N/A		

Results and Data Analysis

This section is divided in two subsections, i.e., student perspectives and liaison perspectives. Each subsection covers the research questions studied through the student data and the liaison data respectively. The subsections are organized by institution.

1. Student Perspectives

a. Are project liaisons critical for the success of student teams delivering successful projects?

The Blue program's final course management surveys for the five academic years between 2019 to 2024 were reviewed for liaison-related comments. The surveys included the prompts:

- Experiences you particularly liked
- Improvements you would like to see
- Please comment on how your [course] experience met your expectations.

Table 3 shows a summary of the number search results for mentions of the words "liaison" or "sponsor" in the responses reviewed, with respect to the positive or negative sentiment. The table also indicates whether the comments came from students whose teams met or exceeded the project expectations. Teams that exceeded the project expectations were identified at the end of each respective year through a consensus between the course faculty and the sponsor liaison(s).

Table 3: Summary by Team of Liaison Evaluations taken from the Student Course Evaluation Data

Academic Year	Number of teams	Team exceeded, or met expectations	Teams with students who made **Positive** comments about liaison(s)	Team exceeded, or met expectations	Teams with students who made **Negative** comments about liaison(s)	Team exceeded, or met expectations	Team with students who made **Positive** & **Negative** comments about liaison(s)
2019-20	13	2 exceeded 11 met	3	1 exceeded 2 met	2	0 exceeded 2 met	1 met
2020-21	14	2 exceeded 8 met	5	2 exceeded 3 met	0	0 exceeded 0 met	0
2021-22	11	3 exceeded 8 met	7	2 exceeded 5 met	4	0 exceeded 4 met	3 met
2022-23	18	6 exceeded 12 met	3	3 exceeded 0 met	8	3 exceeded 5 met	1 exceeded
2023-24	17	9 exceeded 8 met	6	5 exceeded 1 met	4	1 exceeded 3 met	0
Totals	**73**	**22** exceeded **47** met	**24** (33%)	**13** exceeded **11** met	**18** (25%)	**4** exceeded **14** met	**5**

Based on the five years of data summarized in Table 3, students from one-third of the teams made positive remarks about their liaisons. Students from one-fourth of the teams made negative remarks about their liaisons, though almost a third of these also had students make positive remarks. The results also show that 59% of the teams that exceeded expectations had students who volunteered positive comments about their liaisons. This relationship is lower, 23%, for teams who met but did not exceed expectations. Regarding teams with students who made negative comments related to their liaisons, 18% (4 out of 22), were on teams that exceeded expectations and 30% were on teams that met expectations. These indications that students who expressed positive experiences with their liaisons were more likely to be in teams that exceeded expectations inspire the development of a study to determine if there is a positive correlation between students' experiences with their liaison and team overachievement.

Some students criticized some course assignments citing their sponsor had no interest in discussing them. Ensuring liaisons and faculty are on the same page might prevent students from having these types of negative perceptions.

b. Do students appreciate liaisons who are deeply invested in their work?

Out the 42 student comments about their experience working with the liaisons, 24 expressed appreciations for that experience. Some representative examples of these comments include:

- “I really enjoyed the interaction with the sponsor. Having an actual stakeholder to speak to was very good, and our liaison was really fun.”
- “professional development and interactiveness (sic) with our sponsors/liaisons was probably the most fruitful aspect of the program.”
- “I liked collaborating with our sponsor's engineering team through our liaison.”
- “I liked that we had a great connection with our liaison engineers, it gave us a reason to improve our product to reach an end goal.”
- “Working with a liaison engineer was very rewarding”

Out the 43 student comments about their experience working with the liaisons, 18 were negative. Some representative examples of these comments include:

- “I don't like to blame other people for my problems. But I really feel like the sponsors screwed us from the start this year. Extremely vague [project definition], had to grill them on a call about what the system would actually do. "What are your specifications as far as runtime, packages, etc?" "Use whatever you want". … A too-chill, whatever-you-want approach is not sustainable. We are curious but naive students who need guidance. In speaking to other students, I noticed similarities and differences with the feelings I had, and a lot of it came down to sponsor preparedness and engagement.”
- “Was expecting an actually helpful and useful liaison and sponsor. Would have been nice to get direct insight from an engineer who's worked on the problem.”
- “One of the biggest problems my team encountered was personality differences with our liaison.”
- “My liaison mostly wanted to do things on their own terms, and it was difficult to work with them.”
- “Our liaison was very unreasonable in his expectations of our team and at time left us discouraged and unappreciated as we worked very hard on the project”

These comments suggest that students who get to work with deeply invested liaisons will appreciate that experience. Paired with the fact that most of the positive comments came from the highest performing teams, these results further support the literature regarding the relationship between a deeply invested liaison and team success.

a. Are project liaisons critical for the success of student teams delivering successful projects?

The Orange program’s final course management surveys for the five academic years between 2019 to 2024 were reviewed for liaison-related comments. This survey is a superset of the end-of-course survey instrument used by the Blue program. The survey responses are completely anonymous, so it is not possible to correlate the comments about liaisons with the expectation achievement (did not meet, met or exceeds) for the respondent’s team as shown in Table 3. As a proxy for expectation achievement, a student satisfaction rating is used. Table 4 shows the

summary of the search results for mentions of the words “liaison,” “sponsor,” or “client” in the responses to the following open-ended prompts:

- “What problems have you encountered with the course or project in [course numbers]?” (Problems)
- “What improvements would you like to see in [course numbers]?” (Improvements)
- “What experiences in [course numbers] have you particularly liked?” (Likes)

The number of teams and total number of students is included. The last column of the table summarizes the responses to the prompt “Overall, how satisfied or dissatisfied are you with your experience in [course numbers]?” The satisfaction ratings are reported on a 5-point Likert scale with the following choices: Very Dissatisfied (VDS), Dissatisfied (DS), Neutral (Neu), Satisfied (S) and Very Satisfied (VS). From this view of the data, there does not appear to be any statistically valid correlation between having a negative liaison/client/sponsor experience with dissatisfaction with the course sequence.

Table 4: Summary by Year of Liaison Mentions Taken from the Student Course Evaluation Data

Year	Teams	Students	Mentions “liaison”, “client” or “sponsor”			Satisfaction: VDS/DS/Neu/S/VS*
			Problems	Improvements	Likes	
2019-20	9	50	1	1	1	0/1/1/0/0
2020-21	6	33	3	1	1	1/1/0/1/2
2021-22	8	48	2	0	1	0/0/0/0/3
2022-23	9	40	5	2	3	2/1/2/1/2
2023-24	7	39	4	4	4	1/1/5/3/1

*Satisfaction key: Very Dissatisfied (VDS), Dissatisfied (DS), Neutral (Neu), Satisfied (S), Very Satisfied (VS)

Table 5 shows a count of positive, negative and neutral comments about liaisons by year from end-of-course evaluations along with the students’ course satisfaction ratings. Out of the 210 students surveyed, only 10 positive, 21 negative, and 2 neutral comments were captured. These responses represent 4.8%, 10%, and less than 1% of the total possible responses, respectfully. A pattern is not obvious from this data representation. Table 6 maps the comment evaluations (positive, negative and neutral) with the corresponding student course satisfaction ratings. For students that made negative comments about the liaison, there is no apparent correlation with their course satisfaction level as 9 of the 21 negative comments were coupled with satisfied or very satisfied ratings, and 7 of the 21 negative comments were coupled with dissatisfied or very dissatisfied ratings. For those students making positive comments, 6 of 10 were satisfied or very satisfied, 3 neutral, and only 1 dissatisfied. The data suggests that a positive liaison comment is likely to be associated with a satisfying course experience.

Table 5: Summary by Year of Liaison Evaluations Taken from the Student Course Evaluation Data

Academic Year	Number of students	Students who made **Positive** comments about liaison(s)	Student course satisfaction ratings*	Students who made **Negative** comments about liaison(s)	Student course satisfaction ratings	Students who made **Neutral** comments about liaison(s)	Student course satisfaction ratings
2019-20	50	1	Nue:1	2	DS:2	0	
2020-21	33	1	VS:1	4	VDS:1, DS:1, S:1, VS:1	0	
2021-22	48	1	VS:1	2	VS:2	0	
2022-23	40	3	S:2, VS:1	6	VDS:1, DS:1, Neu:2, S:2	1	VS:1
2023-24	39	4	DS:1, Neu:2, S:1	7	VDS:1, Neu:3, S:3	1	Neu:1
Totals	**210**	**10** (4.8%)	DS:1, Neu:3, S:3, VS:3	**21** (10%)	VDS:3, DS:4, Neu:5, S:6, VS:3	**2** (1%)	Neu:1, VS:1

*Satisfaction key: Very Dissatisfied (VDS), Dissatisfied (DS), Neutral (Neu), Satisfied (S), Very Satisfied (VS)

Table 6: Mapping of Liaison Comments into Student Course Satisfaction Ratings

Satisfaction level	**Negative comments**	**Neutral comments**	**Positive comments**
Very Satisfied (VS)	3 (2021:1, 2022:2)	1 (2023)	3 (2021:1, 2022:1, 2023:1)
Satisfied (V)	6 (2021:1, 2023:2, 2024:3)	0	3 (2023:2, 2024:1)
Neutral (Neu)	5 (2023:2, 2024:3)	1 (2024)	3 (2020:1, 2024:2)
Dissatisfied (DS)	4 (2020:2, 2021:1, 2023:1)	0	1 (2024)
Very Dissatisfied (VDS)	3 (2021:1, 2023:1, 2024:1)	0	0
Totals	21	2	10

b. Do students appreciate liaisons who are deeply invested in their work?

For this research question, the student comments were examined for evidence. The comments suggest the students are satisfied when the liaison is responsive to team requests and available to meet regularly. A few comments that support this question mention “the opportunity to work with a real sponsor on a real project was incredibly helpful and motivating,” and “it was nice to

just keep in touch with the project sponsors and consistently talk to them about what we are doing and compare it with how they handle things at work."

2. Liaison Perspectives

a. Do engineers enjoy the project liaison experience?

For this research question, liaisons were asked about their experience as academic project liaisons, their mentorship role in those experiences, their interest in future liaison opportunities, and whether they would recommend this role to their colleagues. Table 2 showed that multiple respondents have been liaisons for various years. Coincidentally, the respondents with two and three years of liaison experience described that for their first experience they were assigned for the role by their supervisor, while those with six years or more described volunteering for the role. The four more experienced liaisons explicitly described loving the experience while the least experienced described how the role allows for a "great collaborative opportunity to prepare students for the workforce". All respondents described a strong interest in future opportunities and that they would recommend the role to their colleagues. Two respondents consider themselves to be mentors to the students and further described how they consider that role to be critical for team success. Two respondents described a limited mentorship role due to the lack of interactions outside the project meetings, but an interest when the opportunity arises.

While these results may be biased as deeply invested liaisons who enjoyed the experience were more likely to participate in this study, the experience itself can be enjoyable.

b. Do engineers benefit from the project liaison experience?

For this research question, liaisons were asked which, if any, benefits they have obtained from their liaison experiences. All respondents described some type of benefit including career growth, development of communications skills, recruitment for the company, personal satisfaction from contributing to education and helping students, and learning from the students about current trends in education, technology and the social dynamics of their generation. Based on responses described in the previous question, some liaisons have also benefited from developing their mentorship skills.

c. Are engineers prepared for the liaison role?

For this research question, liaisons were asked about their challenges in this role and if they could have benefitted from help in preparing for the role. Respondents described challenges regarding 1) themselves, such as their time commitment, 2) their liaison tasks, and 3) helping the students. Challenges for liaison tasks included scoping the project, balancing between over-assisting and under-serving, and ensuring they remain on schedule. Challenges with helping the students included guiding the team to envision the project intricacies, being confident and timely with decision making, and how to avoid instances of underperforming members.

All respondents indicated that it would be beneficial for new liaisons to receive guidance for the role before the experience and throughout their first year, as relevant tasks arise. They suggested

topics such as expectations from the students, interaction with faculty, course deliverables, and student mentorship.

d. What actions or approaches can liaisons take to improve the project experience?

For this research question, liaisons were asked about actions or approaches a liaison could take to enhance the students' learning experience and the project deliverables.

Liaisons mentioned past success with helping the students understand the context of the project, the value of detail-oriented development, the benefits of a process-driven solution rather than rushing to a result, how to recognize the constraints during project planning, and how to focus on their goals to avoid unnecessary time on boundary conditions. They described successful liaison strategies such as early on providing guidance on the tools and skills the students will need for the project, that every student must present their own technical contributions and demonstrate that the team has a balanced workload, and the importance of deliverables and milestones. To help students feel comfortable and motivated, liaisons described the importance of setting expectations that they are here to help and leading by example with actions such as investing critical time early on, carefully reviewing their work, teaching the pertinent technical nomenclature, and providing professional feedback sessions after major presentations. Finally, they emphasized the value in building a good relationship with the course faculty to share concerns and present a unified approach for student and project development.

Best Practices for Industry Liaisons in Engineering Design Projects

The analyses from the literature review and the findings above enabled producing a collection of best practices to ensure a positive and productive experience for the students and liaisons. Table 7 lists these practices, including the potential benefits, suggestions for implementation and metrics for success.

Table 7. Best Practices for Industry Liaisons in Engineering Design Projects

Practice	Potential Benefits	Suggestions to Implement	Metrics for Success
Time allocation	Helps the team to avoid delays. Allows the team to build relationships.	Allocate at least 2 hours per week for role tasks.	Team's requests are filled within one week Meetings allow for conversations outside imminent project needs

Practice	Potential Benefits	Suggestions to Implement	Metrics for Success
Team building	Fosters honesty. Increased student motivation. Student empowerment.	Learn all their names. Treat them with respect. Bring high expectations. Set early expectations for communication. Be a student mentor. Practice inclusivity. Appreciate their uniqueness. Embrace their learning experience.	Open communications Team is receptive to constructive criticism Team success Student positive feedback
High expectations for project deliverables	Team overachieving expectations.	Describe the impact of the project for you and your organization. Describe expectations for their timely deliveries. Highlight enthusiasm for their productivity	Project needs and wants
Lead by example	Liaison professional development. Sponsor organization recognition. Team overachieving expectations.	Carefully review deliverables promptly. Provide student performance comments. If rescoping the project, consider the impact on the team's academic disciplines Assist team in obtaining support items. Practice modesty.	Student positive feedback
Identify a backup or co-liaison	Helps the team to avoid delays. Reduces tasks load.	Enlist the coworker before the project begins. Establish expectations. Share the role trainings.	Continuity of operations Student positive feedback

Practice	Potential Benefits	Suggestions to Implement	Metrics for Success
Faculty relationship	Avoid project delays. Avoid conflicts in student motivation. Avoid team dysfunction.	Establish consonance between the project needs and the course tasks. Establish expectations for communication. Establish expectations for students. Expect training and support before and during the project period. Voice concerns early on.	Faculty positive feedback Uniform student contributions
Define personal goals	Personal development. Professional development.	Establish expectations for the liaison tasks. Periodically review expectations with faculty. Consider student mentorship. Inquire about additional opportunities in the course such as guest speaker or with curriculum input. Embrace your experience.	Student positive feedback Faculty positive feedback Liaison objectives are met
Clarify sponsor expectations	Avoid project delays. Avoid student discontent with sponsor. Avoid scope creep. Avoid student disengagement.	Verify expectations. Confirm allotted time for liaison role. Confirm availability of required resources. Ensure timely escalation of project issues to higher management when needed. Consider impacts on students with disciplines that may no longer be required before rescoping the project.	Project needs and wants. Team's requests are filled within one week. Team positive feedback.

Conclusion

This work aims to contribute to a deeper understanding of how the role of the liaison contributes towards a successful project delivery and a fulfilling educational experience for both the students and the liaison. Through analysis of insights from literature, and experienced students and liaisons from two capstone courses from two institutions, the findings suggest a positive

correlation between students' satisfaction with the project experience, their satisfaction working with their liaison, and liaison satisfaction with the experience. The authors encourage faculty who work with industry liaisons to enhance their documentation for liaisons with the guidelines presented in this paper. These guidelines provide a comprehensive set of best practices to ensure a positive and productive experience for the students and liaisons. The authors also encourage industry professionals to strongly consider project liaison opportunities, as these roles, with the proper support, can offer multiple personal and professional development benefits.

Future Work

The authors will continue collecting data to augment the results here presented, including data from students, faculty and alumni. Future student course evaluation will contain questions specifically about their experience with their liaisons. Liaison focus groups will also be considered. As currently structured, the liaison data also allows for multiple deep dives to further investigate the research questions from this study.

Lastly, while this work has been focused on engineering capstone design project liaisons and students, there are opportunities to apply lessons learned to earlier undergraduate design courses that work with external clients such as cornerstone design courses with team-based projects. Based on the experiences of the authors, engineering capstone design courses are far more likely than cornerstone design courses to have both significant project scope and paying clients. Further study would need to be conducted to determine if these or other factors influence outcomes for students and liaisons in non-capstone design courses.

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Appendix

Comments involving liaisons, clients or sponsors by program year for the Orange program.

Year: 2019-2020
No. of project teams: 9
No. of students enrolled: 50
Prompt type: Likes
Response: I have enjoyed learning about the design process and the business side of things. I have enjoyed working as a team and have thoroughly enjoyed my particular project. I think the coach and liaison interaction is great.
Evaluation of comment: Positive
Student satisfaction rating: Neutral

Year: 2019-2020
No. of project teams: 9
No. of students enrolled: 50
Prompt type: Problems
Response: Difficulty with liaison company and project scope was too broad for the time frame given.
Evaluation of comment: Negative
Student satisfaction rating: Dissatisfied

Year: 2019-2020
No. of project teams:
No. of students enrolled:

Prompt type: Improvements
Response: Perhaps more involvement from liaisons and more direct involvement from relevant professors at [school].
Evaluation of comment: Negative
Student satisfaction rating: Dissatisfied

Year: 2020-2021
No. of project teams: 6
No. of students enrolled: 30
Prompt type: Improvements
Response: I think posting examples of main reports is critical as well as going over what expectations are for each of the main sections and explaining what is in the handbook. Also, the communication of scope of work from our sponsor company was frustrating because we didn't get to do much more than advise them until the spring semester but we felt overwhelmed by competing requests from the class, our coach, and our sponsor company.
Evaluation of comment: Negative
Student satisfaction rating: Very Dissatisfied

Year: 2020-2021
No. of project teams: 6
No. of students enrolled: 30
Prompt type: Problems
Response: Sometimes it takes a while to hear back from our liaison.
Evaluation of comment: Negative
Student satisfaction rating: Very Satisfied

Year: 2020-2021
No. of project teams: 6
No. of students enrolled: 30
Prompt type: Problems
Response: Constant changes from liaison engineer
Evaluation of comment: Negative
Student satisfaction rating: Satisfied

Year: 2020-2021
No. of project teams: 6
No. of students enrolled: 30
Prompt type: Likes
Response: The effort put in by the faculty for this course is unmatched. I'm amazed at the quality and quantity of materials available to us. [GTA] in particular has been very helpful, and I am very thankful that she cares enough to give us critical, actionable feedback. I also enjoyed the high expectations of the class. Though they might have been overwhelming at times, in the end, I think they helped my team to create something great for our sponsor. Also, the opportunity to work with a real sponsor on a real project was incredibly helpful and motivating.
Evaluation of comment: Positive
Student satisfaction rating: Very Satisfied

Year: 2020-2021
No. of project teams: 6
No. of students enrolled: 30
Prompt type: Problems
Response: Hold ups with the sponsor happen sometimes.
Evaluation of comment: Negative
Student satisfaction rating: Dissatisfied

Year: 2021-2022
No. of project teams: 8
No. of students enrolled: 48
Prompt type: Problems
Response: Difficulty with talking to sponsor due to spotty internet
Evaluation of comment: Negative
Student satisfaction rating: Very Satisfied

Year: 2021-2022
No. of project teams: 8
No. of students enrolled: 48
Prompt type: Problems
Response: Difficultly (sic) getting information to assist with the business side of the project from the teams (sic) sponsor company.
Evaluation of comment: Negative
Student satisfaction rating: Very Satisfied

Year: 2021-2022
No. of project teams: 8
No. of students enrolled: 48
Prompt type: Likes
Response: I loved the aspect of working with the project sponsor and coach. It was nice to work with the coach on a weekly basis so they could help us and let us know when something we were needing could come from the sponsor. Also, it was nice to just keep in touch with the project sponsors and consistently talk to them about what we are doing and compare it with how they handle things at work. I loved how detailed we were encouraged to delve into the project. As someone with no real work experience, working on a project of this scale with the sponsors and coach has given me a lot to talk about in interviews.
Evaluation of comment: Positive
Student satisfaction rating: Very Satisfied

Year: 2022-2023
No. of project teams: 9
No. of students enrolled: 40
Prompt type: Problems
Response: A disconnect between what Instructors want from the project and what our sponsor wants from our project.

Evaluation of comment: Negative
Student satisfaction rating: Satisfied

Year: 2022-2023
No. of project teams: 9
No. of students enrolled: 40
Prompt type: Improvements
Response: I would like there to be more of a reason for business students to be in the class. Most sponsors are not concerned with the business student and their outcomes. Similarly, neither is the class. Currently, there is no need for business students to be in the course.
Evaluation of comment: Negative
Student satisfaction rating: Very Dissatisfied

Year: 2022-2023
No. of project teams: 9
No. of students enrolled: 40
Prompt type: Likes
Response: company-sponsored projects
Evaluation of comment: Positive
Student satisfaction rating: Satisfied

Year: 2022-2023
No. of project teams: 9
No. of students enrolled: 40
Prompt type: Problems
Response: One problem we encountered was communication with our liaison. He got busy with company work, and we had to switch primary liaisons throughout. Looking back, I still think that some of the assignments did not fit our project. They were still valuable though as they forced us to consider different aspects of our solution and focus our scope.
Evaluation of comment: Negative
Student satisfaction rating: Satisfied

Year: 2022-2023
No. of project teams: 9
No. of students enrolled: 40
Prompt type: Likes
Response: I have particularly liked working with our company sponsor and gaining skills necessary to complete the project. I also appreciated the leadership team's flexibility with deadlines. So much comes up during the semester that it is not always possible to meet deadlines and also create quality work. Thank you for that. I have enjoyed the opportunity to work with a faculty member as a coach that I probably never would have met otherwise.
Evaluation of comment: Positive
Student satisfaction rating: Satisfied

Year: 2022-2023
No. of project teams: 9

No. of students enrolled: 40
Prompt type: Problems
Response: Some assignments seem irrelevant to our specific project. Some assignments consume more time than necessary, which detracts from more valuable project work and deliverables to the sponsor.
Evaluation of comment: Neutral
Student satisfaction rating: Very Satisfied

Year: 2022-2023
No. of project teams: 9
No. of students enrolled: 40
Prompt type: Problems
Response: Sponsor Liaison doesn't email back, some of the assignments we do in class are not very relevant to the project (i.e. environmental impact), assignments are not very spread out
Evaluation of comment: Negative
Student satisfaction rating: Neutral

Year: 2022-2023
No. of project teams: 9
No. of students enrolled: 40
Prompt type: Improvements
Response: For reports, I think it would be helpful to do sections at a time and get feedback on those sections, it is difficult to correct a whole entire report; more communication with sponsor liaison, more presentation feedback
Evaluation of comment: Negative
Student satisfaction rating: Neutral

Year: 2022-2023
No. of project teams: 9
No. of students enrolled: 40
Prompt type: Problems
Response: More than half of the assignments in the first half of the class were an utter waste of time and I know our sponsor isn't reading our FDR, which is really demoralizing
Evaluation of comment: Negative
Student satisfaction rating: Dissatisfied

Year: 2022-2023
No. of project teams: 9
No. of students enrolled: 40
Prompt type: Likes
Response: Getting a company sponsor and faculty coach has been my favorite part of the course as I got to learn a lot from them with a real world project.
Evaluation of comment: Positive
Student satisfaction rating: Very Satisfied

Year: 2023-2024

No. of project teams: 7
No. of students enrolled: 39
Prompt type: Likes
Response: Our client
Evaluation of comment: Positive
Student satisfaction rating: Dissatisfied

Year: 2023-2024
No. of project teams: 7
No. of students enrolled: 39
Prompt type: Likes
Response: I enjoyed the communication with our sponsor. The project was interesting and a good learning experience.
Evaluation of comment: Positive
Student satisfaction rating: Neutral

Year: 2023-2024
No. of project teams: 7
No. of students enrolled: 39
Prompt type: Improvements
Response: Professors having more contact with sponsors.
Evaluation of comment: Negative
Student satisfaction rating: Satisfied

Year: 2023-2024
No. of project teams: 7
No. of students enrolled: 39
Prompt type: Problems
Response: It has been difficult to keep in contact with our sponsor. Responsibility for this completely falls on us in the current setup, whereas I'd rather see our sponsors be more proactive and have a set meeting time. Ex: meeting biweekly with primary liason (sic)
Evaluation of comment: Negative
Student satisfaction rating: Neutral

Year: 2023-2024
No. of project teams: 7
No. of students enrolled: 39
Prompt type: Improvements
Response: More focus on what works for the sponsor. If sponsor doesn't want to see a final report on various aspects, we should be able to put more of our effort into the deliverables they want as opposed to spending 50% of our time on report formatting and writing.
Evaluation of comment: Negative
Student satisfaction rating: Neutral

Year: 2023-2024
No. of project teams: 7

No. of students enrolled: 39
Prompt type: Problems
Response: interpersonal between the team, lack of resources from sponsor
Evaluation of comment: Negative
Student satisfaction rating: Satisfied

Year: 2023-2024
No. of project teams: 7
No. of students enrolled: 39
Prompt type: Improvements
Response: if sponsors had ALL necessary resources ready or at least accessible before passing it on to ISDers. they already knew what the problem/issue we're trying to solve so why did they not already think about giving us access to what we need, especially because we're on a specific scheduke (sic)
Evaluation of comment: Negative
Student satisfaction rating: Satisfied

Year: 2023-2024
No. of project teams: 7
No. of students enrolled: 39
Prompt type: Problems
Response: Towards the end of the project, we were having a lot of issues that had to do with our project not being updated with the client's current application.
Evaluation of comment: Negative
Student satisfaction rating: Neutral

Year: 2023-2024
No. of project teams: 7
No. of students enrolled: 39
Prompt type: Likes
Response: I enjoyed the opportunity to work with an industry sponsor and address a real-life problem.
Evaluation of comment: Positive
Student satisfaction rating: Neutral

Year: 2023-2024
No. of project teams: 7
No. of students enrolled: 39
Prompt type: Likes
Response: I enjoyed learning so many new things and working with a client
Evaluation of comment: Positive
Student satisfaction rating: Satisfied

Year: 2023-2024
No. of project teams: 7
No. of students enrolled: 39

Prompt type: Improvements
Response: New grading system and re-worked structure between class and client deliverables.
Evaluation of comment: Neutral
Student satisfaction rating: Neutral

Year: 2023-2024
No. of project teams: 7
No. of students enrolled: 39
Prompt type: Problems
Response: Too many assignments, conflict of expectation between client and class
Evaluation of comment: Negative
Student satisfaction rating: Very Dissatisfied