

## A Team Charter to Support Student Engagement in Engineering Design Project-Teams

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# **A Team Charter to Support Beneficial Team Norms for Student Engagement in Engineering Design Project-Teams**

## **Introduction**

In undergraduate engineering programs, project-teams are often utilized throughout the curriculum to help students achieve learning objectives such as working with others, communication, and leadership. Despite the numerous positive outcomes of teamwork and the importance of the development of teamwork skills for engineering graduates [1], [2], low student engagement is a persistent issue for students and instructors [3]. Low engagement by one or more team members within project-teams (commonly coined as ‘social loafing’) is the most reported issue among undergraduate engineering students in team projects [3]. Not only is low engagement damaging to the learning of the student who is not engaging fully, it can also detract from the learning of other team members, as they are unable to participate in an effective team [4]. This work aims to understand how team norms influence student engagement, and provides a framework for team norms to support engagement in the engineering-design team context.

## **Background**

### *Student Engagement*

Student engagement can be understood as the energy and effort that students employ within their learning community [5], observable via any number of indicators, across a continuum from disengaged to fully engaged [6]. This work utilizes Fredrick’s [6] four dimensions of engagement, which categorizes engagement broadly into four domains: behavioural, cognitive, affective, and social. For deep and lasting learning to occur, students must be meaningfully engaged across all four of these domains [7]. Understanding and supporting student engagement is critical across the undergraduate engineering curriculum, as highly engaged students are heavily invested in their work, persist despite challenges and obstacles, and internalise the accomplishments of their work [5]. Critically, student engagement is conceptually distinct from team performance, which is often captured by how well the students meet the requirements of the assignments/course and is reflected in their grades and work products [8]. Although good team performance is commonly used as a proxy for “good teamwork”, team performance does not fully capture how the team works together to complete their tasks or what each student is learning from the project-team experience. A student team may have one student doing the majority of the work above and beyond expectations while others do not engage, and the team may be thus able to meet the expectations of the course and give the appearance of a high-performing team, when in actuality all students within the team are not fully engaged or developing the desired skills and knowledge. Therefore, in this work engagement and teamwork processes are prioritized over the performance of teams.

In the context of engineering-student teams, engagement can be conceptualised as the internalisation of both technical and non-technical knowledge and skills and the expenditure of

significant cognitive and emotional effort to practise and refine these skills. Student engagement is particularly critical in the project-team setting, as the learning outcomes of the course (e.g. development of communication and teamwork skills) require the active involvement of students to participate and meaningfully engage with their other team members. Traditionally, research on student engagement in engineering project-teams has focused heavily on the phenomena of social loafing or ‘free-riding’, which is defined as the tendency of individuals to exert less effort when working collectively than when working individually [9]. Significant work has been done to better understand and reduce the frequency of social loafing in engineering student project teams. Peer feedback is increasingly popular in its use for reducing social loafing [10] however there are drawbacks to this. Ortiz-Marcos et al. [11] found that students may allocate the same score to all team members and/or give scores based on prejudices. Additionally, Willey and Gardner [12] found that students with low engagement often did not take the opportunity to properly produce self- and team-feedback. As an alternative, this work suggests that student engagement can be facilitated through the use of beneficial team norms, as a way to fully support students throughout the design process.

#### *Team Norms*

Team norms can be defined as “standards that regulate group members’ behaviour” [13, p.121]. Norms describe what a group member should do within the group and in response to changes in the group [14]. Some scholars have associated a team’s norm as the team personality or identity, which override individual members’ personalities or identities [15]. Team norms play a significant role in how a team works together, and thus may have significant impacts on the engagement of team members.

In self-managed student project-teams, the team’s norms generally arise organically from the interactions between team members, unless otherwise explicitly structured (such as through a team contract, charter, or agreement). Pattinson et al. [16] framed the creation of these norms as developing through the continuous negotiations between students as they work together. These norms are generally expressed in a subtle and implicit manner, as opposed to explicitly [8], [17], which can make the team’s norms difficult for team members to pinpoint. There is a significant lack of research on what specific norms should be developed within engineering student project-teams to support team functioning and student engagement.

#### *Team Charters*

In undergraduate engineering design classrooms, the creation of explicit team norms are often facilitated through the use of team charters or contracts, where the students outline the expectations for the team within the context of the course [18]. Team charters tend to be of a practical nature, focusing on behavioral norms and expectations of team members [19], including the provisions of roles and responsibilities, the scheduling of regular meetings, and how the team will address conflict. Many of the components of team charters reflect how the team expects

students to engage with both the team and course work, although this aspect is often included implicitly [19]. This may be why the low engagement of some students remains, despite the use of team charters to generally support the formation of beneficial team norms [3]. More research is required to understand what specific types of team norms facilitate or hinder student engagement in these project-teams.

## Methods

This work is part of a larger research project, studying student engagement and the team environment broadly. The research question investigated in this paper is: *What categories of team norms influence student engagement in first-year engineering project-teams?*

A total of 10 students from 7 teams in the first-engineering design class at a large Canadian Research-Intensive University were selected for interviews after participation in a prior stage of the larger research project. Originally, the aim was to have full teams participating in the interviews, in order to have a thorough understanding of the complexity of experiences students within the same team have. Unfortunately, the response rate for students participating in the interviews was lower than expected and it was not possible to have all students from a single team. Instead, students were randomly selected from the pool of participants in the prior research stage on a rolling basis, until the total number of interviews completed was ten and the saturation of codes from data analysis was satisfied [20]. We do not believe that this limitation of participant selection impacts the findings presented in this paper.

Participants were compensated 15 dollars of the school's currency for their participation in the interview. The participants consisted of six women and four men<sup>1</sup>. Nine of the ten students attended high school in English (used as a proxy for English as a second language), while one did not. The students were from four engineering disciplines: Civil/Mineral Engineering, Industrial Engineering, Material Science Engineering, and Mechanical Engineering. A breakdown of the participant demographics is shown in Table 1, below.

Table 1. Participant demographic information.

| Pseudonym | Team | Gender | High School in English? | Engineering Discipline |
|-----------|------|--------|-------------------------|------------------------|
| Amy       | A    | Woman  | Yes                     | Industrial             |
| Alicia    | A    | Woman  | Yes                     | Industrial             |
| Adam      | A    | Man    | Yes                     | Mechanical             |
| Benjamin  | B    | Man    | No                      | Civ/Min                |

<sup>1</sup> This sample is an over-representation of women, as the demographic of the first-year undergraduate cohort at this time was approximately 40% [21].

|           |   |       |     |            |
|-----------|---|-------|-----|------------|
| Blake     | B | Man   | Yes | Civ/Min    |
| Caroline  | C | Woman | Yes | Mechanical |
| Douglas   | D | Man   | Yes | Mechanical |
| Elizabeth | E | Woman | Yes | Civ/Min    |
| Felicia   | F | Woman | Yes | Civ/Min    |
| Ginny     | G | Woman | Yes | MSE        |

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Semi-structured, open-ended interview protocols were developed for use in this study. To minimize the effect that our protocol had on data collection, it was designed to provide a structure through the order and wording of key questions, while maintaining flexibility for both the interviewer and interviewee to probe student experiences with further questions or additional details when required [22]. For example, a question from the interview guide is: *“Is there something your team members might have done to help you engage more easily?”* Depending on the student’s response, follow up questions would probe for further details such as *“Why might that have helped?”* and *“Is this something that was normalized in your team? Why do you think that is?”*.

Interviews were conducted with individual students privately, with the hopes of providing a safe space for students to speak freely about their experiences. These interviews took place 4 weeks following the end of the design course and term. All interviews were recorded and transcribed via Zoom. Following the interviews, the researcher manually edited the automatic transcription to ensure accuracy. At the beginning of each interview, the researcher read through the ethics protocol with the students, reminding them that their interview was entirely voluntary and confidential.

Data analysis was conducted using a hybrid approach of thematic coding which integrated both deductive and inductive methods [23]. In the first stage, deductive coding was applied to identify and categorize interview excerpts related to student engagement using Fredricks’ [6] four dimensions of engagement as the guiding framework. After categorizing engagement instances, we further investigated to determine the types of team norms that were described as influencing these instances of engagement. In other words, our goal was to determine what team structures, processes, and expectations led to certain levels of student engagement. We developed these team norms inductively, as they had not been previously identified in the literature.

Following the methodology outlined by Naeem et al. [24], an inductive coding process was conducted to develop the categories of team norms. During the initial round of inductive coding, keywords that described the team’s processes/structures/expectations that influenced engagement were identified (e.g., “procrastinate,” “urgently,” “scrambling”) . These keywords were

subsequently grouped into higher-order codes (e.g., “deadline-driven urgency resulting in negative emotional engagement”), which were then organized into broader themes to capture recurring patterns across the dataset (e.g. “reliability of the team influences engagement”). These themes were conceptualized as “categories” of team norms, to capture the wide range of possible team norms that students discussed, instead of prescribing specific norms.

To enhance the credibility of the analysis, peer debriefing was conducted throughout the research process [25]. This involved structured discussions with graduate students and professors to compare interpretations, challenge assumptions, and refine thematic development. This process supported critical reflection and helped identify and mitigate potential researcher bias [25].

## Findings

The thematic analysis gave rise to six major categories of team norms that can help explain changes in student engagement. These categories are: Amount of Collaboration, Prioritization of Personal Relationships, Expectations for Reliability, Flexibility in Roles and Responsibilities, Expectations for Fairness, and Amount of Value. The descriptions of these categories are included in Table 2, below.

Table 2. Descriptions of the categories of team norms influencing student engagement.

| Category of Norms                         | Description                                                                                                          |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Amount of Collaboration                   | How closely the team works together to achieve their goals.                                                          |
| Prioritization of Personal Relationships  | The degree to which personal relationships and friendships are developed within the team.                            |
| Expectations for Reliability              | Amount of latitude in the expectation that team members will follow through on their commitments.                    |
| Flexibility in Roles and Responsibilities | The degree to which the team is flexible and fluid in team member roles and responsibilities.                        |
| Expectations for Fairness                 | The team’s degree to which the team expects the workload to be equal rather than equitable.                          |
| Amount of Value                           | The value given to the project-team experience and the design course as a whole in comparison to other courses/work. |

These six major categories of norms identified from the interviews describe the processes by which a team works together in various ways. Each of these categories of norms can be considered as a spectrum. Through further thematic coding of the interview data, team norm spectrum descriptors were developed to help teams and instructors develop an understanding of how a team has structured themselves across these norm categories. The spectrum descriptors

have not been validated and should only be used as a tool for conceptualizing the various levels of these phenomena within the project-team context. These spectrum descriptors may be particularly useful if used in conjunction with the Team Charter presented in Appendix B, as the students may find it helpful to see how previous teams structured their norms within these categories before deciding how their own team will be structured. The team norm spectrum descriptors can be found in Appendix A.

Interestingly, we found that it was not necessarily specific team norms which led to student engagement, but it was the *alignment* of students within the team for each category of norm. When there is a misalignment, the student may feel frustrated and less willing to engage with the team, resulting in a decrease in engagement. An example of this misalignment in regards to the Prioritization of Personal Relationships norm was discussed by Caroline. Caroline explained that she preferred to be social with her other team members, but this was not reciprocated within the team. She described her team as:

*“Very much like a transactional group, like there was no social aspect. We didn't do anything [together]. It was just like, we're here because we have to be, you know, versus... with my old team, [we would] like bring food to our meetings and have fun and talk about our other interests. And like we went out for dinner after our final presentation. It was very much more like, they're my friends.”*

This misalignment led to feelings of frustration and disengagement from Caroline, as she missed the high level of prioritization of personal relationships in her previous team.

Elizabeth also discussed the misalignment of her preferences and the team's norms, particularly in terms of the Expectations for Reliability category. She explained:

*“I found I was closer to the members who actually attended the meetings than I was to [a student who did not attend]. There was a disconnect, and I can't speak for my other team members, but also, I had this annoyance for him the whole time because it's like, I took my time to come to these meetings, you know, and have the respect to be there.”*

Elizabeth clearly had a different expectation for reliability than the student on her team who was often absent. While Elizabeth expected students to fulfill their obligations fully, including attending all meetings, the norm within the team was to generally attend the meetings if possible, but without a strict requirement to do so. This misalignment between expectations and actions resulted in Elizabeth's engagement suffering.

In order to facilitate the alignment of individual expectations and the norms within the team, it is critical that students discuss how their team will work together in accordance with these six

categories. To support these discussions, we have developed a Team Charter (to be used as a stand-alone or to supplement existing charters) specifically designed to align expectations around these team norms, which can be found in Appendix B.

## **Discussion**

This work has provided a better understanding of the specific categories of team norms which influence the team environment and student engagement. The categories of norms presented in this work were found to be related to one another in various ways, as certain team norms are likely to influence other team norms. For example, teams that are highly collaborative and spend more time together may be more likely to prioritize the development of personal relationships within the team. As Adam described:

*“I think [our friendships] mainly just kind of happened because we're just working together... We're interacting with each other. And so we kind of just built a good friendship, especially since we were interacting so well from the beginning.”*

Other relationships were also identified through data analysis; teams that prioritize fairness may also prioritize flexibility, as the students aim to contribute equally and thus may step into other roles or responsibilities as needed to create an even workload. The fairness norm may also affect reliability, as a team that prioritizes fairness would be likely to be dependable to ensure that fairness is maintained, and certain team members are not left in disadvantageous positions compared to others. Lastly, teams that care deeply about the course may be more likely to put the time and effort into developing and maintaining the five previous norms, as they see the value in positive teamwork experiences within the course. These connections are both advantageous, and dangerous. The improvement of one team norm may have a water droplet effect of further positive influences on other norms, however one damaging norm could have a poisoning effect within the team. It is therefore critical to acknowledge and support the development of all categories of norms, to support the team as a whole.

Critically, the alignment and misalignment of team norms was shown to influence engagement within the team, regardless of the specifics of the team norm. This alignment is referred to in psychological contract literature as expectations mismatch [26]. When team norms align with individual expectations of the team, there is a positive feedback loop, supporting the engagement in ways that perpetuate the norm (e.g. if the team expects reliability and the team member agrees with this expectation, engagement is supported). When team norms and individual expectations are misaligned or are unclear, engagement is hindered as the student struggles to understand how to engage. These norms may be perpetuated anyway if the other team members continue to work in these ways.

It is important that instead of trying to impose certain team norms within student teams, instructors support the negotiated *alignment* of these norms with the personal beliefs and

preferences of each student in order to facilitate engagement and ensure that all students agree with how the team should work together. This is especially critical as instructors are likely to have their own beliefs about how a team should work together along these categories, and these beliefs may not align with those of the students. For example, an instructor may believe that personal relationships should not be prioritized and are in fact a distraction from the work at hand. By imposing a “professional” team norm, the students may feel uncomfortable and unsupported if they would prefer to have a social environment within the team. It is of utmost importance for instructors to facilitate the negotiation of team norms that better align with each student’s personal beliefs and preferences, rather than what the instructor believes is “correct”.

Current team contracts in use within engineering education classrooms may not explicitly represent the six norms presented in this work. The students within this study had all produced team contracts with their teams, however many students expressed misalignments with aspects of the norms that their teams held, despite the use of the contracts at the beginning of the term and a prompted revision of the team charter at the mid-point of the term. It is therefore recommended that instructors ensure all six categories of norms are represented and considered within team contracts, and students are supported in developing positive team norms as they work together, in order to facilitate alignment.

### **Limitations**

There are several limitations to this work. This study involved a relatively small sample size ( $N=10$ ) and seven teams, which limits our understanding to a small subset of the first-year engineering population. This research occurred with students from only one first-year engineering design course at a large Canadian Research-Intensive University, which limits generalizability to other institutions and other years of study. There is also likely bias in the self-selection of participants interested in participating in the study: more highly engaged students are most likely more willing to participate in the interviews, while students with lower engagement are less likely to participate. This was mitigated through financial incentives to participate. These interviews also took place four weeks following the end of the term, which may affect the students’ recollection of events and of their experiences throughout the term. It may be more difficult for students to remember specific processes of their teams, and how they may have changed throughout the term due to this delay.

### **Recommendations and Future Work**

Included in Appendix B is a team charter specifically designed to address the six categories of team norms discussed in this paper. It is recommended that this team charter be used either as a stand-alone, or in conjunction with other team charters depending on the context and needs of the course. It is also recommended that this team charter is utilized in conjunction with the Team Norm Spectrum Descriptors presented in Appendix A to assist the students in articulating their preferences for the team work. A point of focus must be placed on not merely the specifics that

the team inputs into the team charter, but the alignment of expectations between students. There must be a cultural shift from students submitting a team contract that they believe the instructor will approve of, to a team contract that actually reflects the beliefs and desires of the students within the team. It must be explicitly stated that the purpose of the team charter is to discuss and thoroughly negotiate these norms between students, rather than completing it as a performative assignment. To assist in this, we recommend providing class time dedicated to working through the team charter and team norm spectrum descriptors, with instructor support to encourage conversation and the inclusion of differing perspectives.

It is critical that this team charter is revisited by the team regularly throughout the course in order to facilitate the renegotiation of team norms along these categories to support continued student engagement. This has been noted as a key component to improve the effectiveness of team charters in previous research [27]. We recommend structuring renegotiation opportunities regularly over the term to assess the alignment of the team on these term norms as the team develops over time. Further, instructors should facilitate the norm setting and norm renegotiation processes in order to support all students in creating alignment for their team norms and personal expectations.

Further work should test the efficacy of this team charter with engineering design project teams to determine if significant differences in student engagement result from its usage. This may be done by selecting one section of the course to use the charter that has been used in previous offerings, and another section to use the engagement-specific charter. Student engagement should be measured at multiple time points throughout the term using verified survey scales such as those presented by Naibert and Barbera [28]. The levels of engagement between groups should be compared to assess the efficacy of the charter presented in this paper. Further work could also assess the generalizability of this work's findings by assessing if these categories of team norms are relevant in other contexts, such as at different universities or at different levels of study (e.g. capstone instead of first-year teams). Due to the novelty of design project-teams for many first year students, there may be differences in the effects of team norms on engagement at various levels of experience.

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## Appendix A. Team Norm Spectrum Descriptors

| Team Norm                                 | Low                                                                                                                                                                                                                       | Medium                                                                                                                                                                                             | High                                                                                                                                                                                          |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Amount of Collaboration                   | Team members seldom collaborate and often work individually with few team meetings.                                                                                                                                       | Team members collaborate for some aspects of the project but also prioritize individual work for other aspects.                                                                                    | Team members are highly collaborative, giving feedback at regular intervals and often having team meetings to work together.                                                                  |
| Prioritization of Personal Relationships  | Team members prioritize developing professional relationships with one another. Conversation focuses largely on project work.                                                                                             | Some effort is put forth in developing personal relationships, while “professional” relationships are maintained.                                                                                  | Team members prioritize developing deep relationships with one another, often resulting in friendships. Conversations include those of a personal nature.                                     |
| Expectations for Reliability              | Team members prioritize a high level of flexibility regarding internal deadlines. Work is expected to be completed by the external deadlines of the course, but each team member manages their own workload and timeline. | Team members sometimes complete their tasks and responsibilities by the team’s internal deadlines and may (but aren’t required to) communicate if they are unable to do so.                        | Team members consistently complete their tasks and responsibilities to the best of their abilities by the established deadlines and communicate openly if they are unable to meet a deadline. |
| Flexibility in Roles and Responsibilities | Team members stick very closely to the roles and responsibilities established in the team. Little cross-over occurs between the roles and responsibilities of team members.                                               | There is some flexibility in the roles and responsibilities between team members. Other team members may assist and fill in for certain roles/responsibilities if they are unable to be completed. | Roles and responsibilities within the team are flexible, with team members of differing roles and responsibilities often assisting and flowing based on the needs of the team.                |
| Expectations for Fairness                 | Team members put forth a minimum amount of effort, and if other team members want to put more effort forward, they are welcomed to.                                                                                       | All team members put forth a good faith effort to complete their work to an acceptable degree, and if other team members want to put more effort forward, they are able to.                        | All team members put forth the same amount of effort, to the best of their ability, in order to complete the work to the highest degree possible.                                             |
| Amount of Value                           | Team members have little care for the course and do not see the value in teamwork. The course and coursework are a lower priority than other courses and experiences.                                                     | Team members have some care for the course and see some value in their course and teamwork. This course is seen as having equal importance to other courses and experiences.                       | Team members care deeply about the course project and their teamwork and prioritize it over other courses.                                                                                    |

## **Appendix B. Engineering Design Team Charter for Engagement**

### **Team Information**

Project Name: \_\_\_\_\_

Course / Section: \_\_\_\_\_

Team Number: \_\_\_\_\_

Date Created: \_\_\_\_\_

### **Team Purpose**

As a team, our shared goals for this project and course are:

#### **1. Amount of Collaboration**

*How closely will we work together on tasks and decisions?*

Tasks we will complete together as a team:

Tasks we may complete individually and then share:

How we will communicate and share progress (meetings, tools, frequency):

## **2. Prioritization of Personal Relationships**

*How will we make space for positive relationships while staying professional?*

How we will build trust and rapport as a team:

Expectations for respectful communication:

Boundaries between social time and work time:

## **3. Expectations for Reliability**

*What does being “reliable” mean for our team?*

Expectations for meeting deadlines and attending meetings:

How we will communicate delays or challenges:

How the team will address missed commitments or deadlines:

#### **4. Flexibility in Roles and Responsibilities**

*How will roles be structured and adapted over time?*

Initial roles and responsibilities (if any):

Expectations for helping outside of assigned roles:

How roles may change as the project progresses:

## **5. Expectations for Fairness**

*How will we ensure fairness in workload and recognition?*

How tasks will be distributed:

How we will monitor workload balance:

How concerns about fairness will be raised and resolved:

## **6. Amount of Value Placed on the Team and Course Experience**

*How much do we value this project and team experience?*

What success looks like:

Skills or experiences we want to gain:

Amount of time dedicated to the design project on average per week:

## Team Agreement

By completing this charter, we agree to follow the expectations outlined above and revisit them periodically throughout the term.

Team Member Names and Signatures:

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