

Improvement of Project Quality Through Team Building

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Abstract. With any large group project, being able to work effectively as a team is the backbone to the project's success. Nowhere is this clearer, than with capstone teams comprised of student engineers who are getting their first experience with larger projects that last two semesters. Not only are the projects larger in scope than most students have experienced, they often require engineering students from different disciplines to work together to complete a variety of sequential and non-sequential tasks. The combination of inexperienced engineering students, long timelines, and different engineering backgrounds often leads to teams being divided, which greatly hinders the performance output of the team. In this work, we will discuss some of the challenges that appear when capstone engineering students are required to collaborate amongst themselves, along with psychological tools that can be used to potentially create better team performance, as well as achieve a more fulfilling experience. The overarching goal is to help ensure students complete the capstone class with a successful project, and confidence in their ability to work as a team, which will make them better engineers in industry.

Introduction. With any project that requires individuals to become a team to complete a challenging task, there is a likelihood for conflict to arise. The conflict can be amplified when the team members are inexperienced, as they have never had to manage any sort of professional conflict for an extended period. Most of the conflicts encountered by capstone teams appear to be from a lack of clarity on roles and expectations, ineffective communication, gossip, poor project management, and poor individual behavior [1-3]. Many of these issues are more easily resolved once students gain experience, get more comfortable working as a team and have better process-based management training [2]. For instance, teams typically learn how to communicate effectively, once they are thrown into an environment that nourishes teamwork. Therefore, as teams get more proficient at working together, the interpersonal team dynamics becomes easier to manage. Other cases of conflict, such as lack of clarity on roles and expectations, may not be identified as naturally as the other forms of conflicts. Everyone has their own set of strengths and weaknesses, and the entire point of being in a team is to best utilize everyone's strengths. Moreover, it can be overwhelming for students to understand the role played by each team member in the grand picture of an entire project. It is for this reason that social psychology could play a vital role in helping the individuals and their teams perform better by better understanding themselves and their teammates. By knowing their personality type, they can better realize what type of role they may play within the team [4]. From this deeper understanding of themselves, they can perhaps see potential conflicts with other students in their groups ahead of time, based only on their personality scores and how they may match up with their teammates[5]. This more aware sense of thinking could ultimately see conflicts arising ahead of time, and avoid them altogether, therefore keeping the project on track.

Methods. The teams of the Fall 2021 capstone class are formed based on the students' most desired choice of project, their demonstrated technical proficiency, and the client's needs for different engineering disciplines. The lack of project management skills and clarity on team roles and responsibilities are a large contribution to dysfunctional teams. To help address these issues, the course lectures are structured around project management and team building. The course is broken into phases that have multiple milestones to keep the students on track. The first assignment, once teams are developed, is to have the members decide which roles and responsibilities are most appropriate for each individual. This provides students with the opportunity to decide a position that fits them best

and allows the team to make their first cohesive decision. To help ensure teams maintain a high level of performance throughout the semester, surveys are assigned weekly to each student to monitor the team's dynamics. The survey is designed to inquire each student in the capstone course about their satisfaction with their teammates, their projects, and their own work. Additionally, a weekly team progress report is assigned to each team and is to be filled out by the members together. This survey allows the team to come together to think critically about past work and future work by having the students summarize the work completed that week and create a detailed list about the planned work for the following week. Surveys are also sent out to the clients of each team. This survey provides an outside perspective on the team's productivity. The client survey asks the client about the satisfaction with the team's work and provides the client with the opportunity to bring up any issues they have experienced. The data from the surveys are recorded and analyzed for positive and negative responses. When issues arise, they are addressed as quickly as possible. A weekly summary of the entire class is compiled by the teaching assistant and presented to the instructor to promptly and strategically address issues.

Future Work. Currently, teams are formed based on the students' disciplines and interest in the projects. Students are allowed to pick their roles and state their expectation of themselves and each other throughout the semester leading to the possibility of similar personality types clashing. To help anticipate and manage conflict within teams, students will take a personality test, like the Myers-Briggs test, to develop better self-awareness and a deeper understanding of their teammates. Teams will be taught how to identify and work with conflict in a productive manner.

Conclusion. Multiple issues can lead to a low-performing engineering capstone team such as lack of knowledge of process-based management (or project management), a lack of clear roles and responsibilities, and clashing personalities. To help teams reach their potential, lectures were created to teach project management and team building skills. Surveys were created and assigned to supervise group dynamics throughout the semester. All issues were addressed promptly to keep customers and students satisfied. Further course enhancements will focus on improving team dynamics through self-awareness.

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