

# Student Interest and Performance Predictors in Capstone Project

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*Inspere*

Capstone programs are a central component of Computer Science and Engineering curricula, designed to assess students and provide experience in developing technical and professional competencies through real-world project work. This study examines how student interests and team formation strategies influence Capstone grade performance. Using data from a Capstone program involving 796 students, we analyze whether factors such as project preference and interest alignment affect individual and team outcomes. Prior to enrollment, students report their areas of interest, relevant experience, and rank at least five preferred projects. Teams of up to four students are then assigned primarily based on project preference, with additional consideration given to GPA, major, and completed coursework. Under this preference-first policy, most students are placed in one of their top-ranked projects. We conduct a retrospective observational analysis to determine whether assignment to a student's first-choice project correlates with performance. The results indicate that project preference does not significantly influence final grades at either the individual or team level. These findings suggest that the project-assignment process is effective and that some flexibility in student-project matching can be introduced without adversely affecting project outcomes.

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## Introduction

Capstone programs are a central component of Computer Science and Engineering curricula, providing a structured opportunity to assess students' readiness for professional practice while giving them experience in industry projects. By simulating real-world environments, they require students to integrate technical and professional skills to deliver complex, open-ended projects. Beyond demonstrating academic proficiency, Capstones foster essential competencies such as teamwork, communication, and project management.

A recurring challenge in these programs is forming effective and well-balanced teams. Common strategies such as random assignment, self-selection, or instructor matching, each present trade-offs. Prior work suggests that students' personal interest in a project can strengthen engagement and sustain motivation, especially in high-stakes, semester-long efforts such as Capstones.

This paper examines the team-formation model used at Inspere Capstone Program<sup>16</sup>, where students rank and select Capstone projects based on personal interest and project requirements. Using data from 796 students since 2018, we analyze relationships among project rankings, interest alignment, GPA, academic background, and both individual and team performance. We focus on evaluating a preference-first assignment policy that prioritizes students' ranked choices during team formation.

## Background

Teamwork is a central component of education<sup>11, 13</sup>, preparing students for the collaborative environments of professional practice<sup>3</sup>. Effective teams help students coordinate, deepen their understanding of problems, and develop positive teamwork experiences<sup>6</sup>. Collaborative learning improves attitudes, morale, engagement, performance<sup>4, 10</sup>, and strengthens students' sense of belonging by providing social support and encouraging question-asking and idea-sharing<sup>5, 8</sup>.

Despite these benefits, forming effective teams remains challenging<sup>7</sup>. Random assignment can create imbalanced teams<sup>15</sup>, while self-selection often reinforces social disparities and produces homogeneous teams<sup>5</sup>. Additional challenges include uneven participation ("free-riders")<sup>13</sup>, limited instructor capacity to monitor team dynamics, and student frustration with coordination overhead. Some students even prefer working alone, a tendency sometimes reinforced by some course cultures<sup>10</sup>.

To address these issues, research increasingly explores algorithmic team-formation methods<sup>3</sup> that incorporate attributes such as academic performance<sup>2</sup>, personality traits<sup>14</sup>, learning styles, communication and social factors<sup>9</sup>, and demographics<sup>8</sup>. A common goal is to create diverse, equitable teams and avoid isolating students from different backgrounds<sup>4, 5, 8</sup>.

## Performance

Collaboration, when implemented effectively, can significantly improve student performance compared to working individually<sup>4, 15</sup>. Teams of four or five often yield strong outcomes when self-selected<sup>10</sup>, and the presence of high-performing students can positively influence their peers<sup>1, 12</sup>. Team interaction patterns, however, can be complex.

Research also suggests that the quality of interactions and individual student factors often matter more than whether teams are formed randomly or based on expertise<sup>15</sup>. This indicates that team formation alone is insufficient; effective collaboration requires intentional instructional support and structure. This is especially relevant in initial courses, where sophisticated grouping strategies may be constrained by limited data on students' abilities and backgrounds<sup>11, 14</sup>.

## Context

The Capstone examined in this study is part of the curriculum at Engineering and Computer Science programs at Insper<sup>17</sup> in Brazil. Projects span one academic semester and are taken in the semester preceding students' final year.

Teams may have up to four students, with interdisciplinary composition determined solely by the project domain and its requirements. By the time students begin their Capstone projects, they have completed all required courses and are enrolled only in electives.

Students are expected to dedicate 24 hours per week to their project, which runs for about four months. Each team is supervised by a faculty advisor who provides approximately four hours of weekly guidance and is also supported by an industry mentor from the sponsoring company, with whom the team meets weekly.

Students submit biweekly self-reports and participate in two rounds of peer evaluation. Although not graded directly, these inputs support the advisor's assessment.

Assessment includes both individual and team-based components. Students receive individual evaluations at midterm and at the end of the semester in the following competencies: Technical Execution, Organization, Communication, and Teamwork.

Team evaluations occur in three stages. A preliminary report outlines the project objectives (assessed but not counted toward the final grade), followed by intermediate and final reports. The advisor evaluates the intermediate and final reports using six competencies: Technical Execution, Organization, Communication, Teamwork, Design, and Entrepreneurial Attitude.

Finally, each team is evaluated by a panel of at least two external faculty members using four of the same competencies: Technical Execution, Organization, Design, and Entrepreneurial Attitude, ensuring the application of a common rubric across all projects.

## Student Project Application

Students register on an internally developed Capstone platform approximately five months before the program begins. This early registration enables the coordination team to collect the information needed for team formation and other preparatory tasks. The first step requires students to indicate their areas of interest (automation, bioengineering, cloud computing, data science, dynamic systems, energy efficiency, mobility engineering, software engineering, social innovation, artificial intelligence, manufacturing, robotics, simulation, embedded systems, interactive systems, information systems and administration, economics and finance). These selections help align preferences with available projects. Students choose from a predefined list and may optionally add other interests.

Students also report whether they have worked or interned at a company, describing the job and the company. This information serves two purposes: assessing their professional experience and identifying potential conflicts of interest for those currently employed. Another question asks whether the student has participated in student organizations, research programs, or other academic initiatives. This experience may be considered during team formation, if the project is related to this prior experience. Students are further encouraged to report involvement in social activities, such as volunteering or community service, which can be an important differentiator for socially oriented projects. A field for the student's LinkedIn profile is also available to support the review of professional background.

Finally, students must rank their project preferences. They select at least five projects, ordered by interest. Each project includes a company-provided description outlining objectives, expected outcomes, required deliverables, available resources, and any additional considerations. Proposals also specify which majors the four available positions are intended for, helping students assess alignment with their background. In some cases, proposals include recommended prerequisite courses.

Students may also view how many peers have expressed interest in each project. As they observe which projects are in high demand, interest patterns tend to spread organically, facilitating the formation of balanced teams. Students have approximately two weeks to review all proposals and submit their ranked preferences.

## Team Formation

Teams are ideally composed of four students. This number was chosen for several reasons: it allows for flexible task division, either collaboratively or in pairs, and it reduces the likelihood that a single student will be marginalized or left out, as can happen in teams of three where two members may already be friends, unintentionally isolating the third.

After students apply for projects, the process of forming teams begins. Since no single objective function can handle all cases, a heuristic approach is used to generate an initial configuration through an automated process. This heuristic prioritizes smaller teams, so they reach the minimum of three members and redistributes students from projects with more than four members, using available data to balance team sizes.

Projects with two or three interested students are favored, as they are more likely to be completed with minor adjustments. Students who applied to projects with more than four interested participants are evaluated for redistribution into underfilled teams (fewer than four members), considering factors such as GPA and alignment of interests. The system avoids drastic changes and may tolerate some imbalance when no better configuration is possible.

Once the automated phase is complete, a near-final solution is produced, typically close to the ideal team configuration. At this stage, students may be manually reassigned based on additional information about their backgrounds and experiences. This step is conducted by the Capstone committee, whose members are familiar with the students and can provide further insights. A final step involves identifying potential conflicts of interest. When a conflict is detected, it is analyzed with all involved parties to determine whether it can be disregarded or requires intervention.

After team formation is finalized, each team is assigned a faculty advisor. Finally, institutional partners are notified of the decisions, and the designated mentor from the sponsoring company is connected with the assigned advisor to begin alignment discussions and address contractual matters, such as signing an NDA (Non-Disclosure Agreement).

### Exploratory analysis of current data

Students are given a wide selection of projects to apply for. Typically, there are far more proposed projects than the number that ultimately form teams. Figure 1 illustrates this discrepancy by showing the number of proposals available for student applications compared with the final number of projects executed across 15 editions of the Inspur Capstone program.

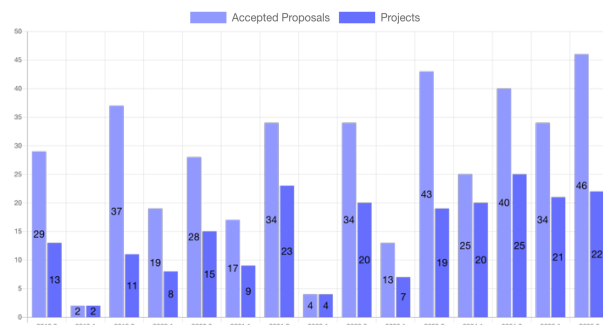


Figure 1 - Proposals accepted vs. projects executed.

While it is not always possible to satisfy every student's top choice for a Capstone project due to various constraints, most students are still placed in their first-ranked option. As shown in Figure 2, 64% of students received their top project preference across the 15 editions since 2018.

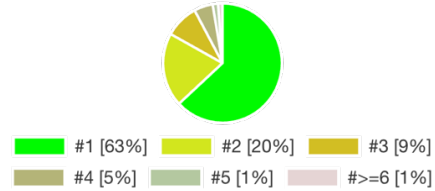


Figure 2- Share of students placed in their top-choice project.

Figure 3 presents a more detailed view, showing this proportion by semester along with the number of students. In the program's early years, the allocation process was less consistent due to several factors, but it has since stabilized as procedures matured.

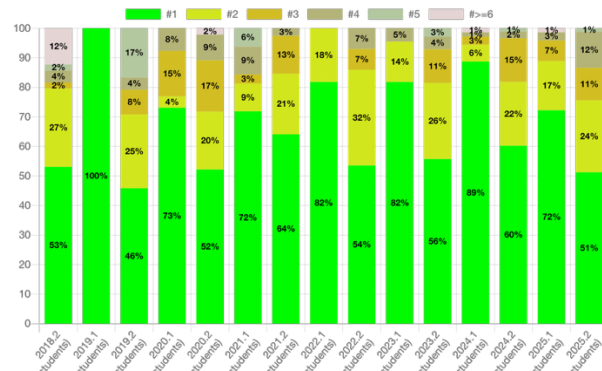


Figure 3- Distribution of top-choice placements per semester.

To examine the impact of project choice on students' final performance, we analyzed the relationship between assignment to a preferred project and final course grades. Both individual and team average grades were considered, as illustrated in Figure 4. Teams not consisting of three or four students, as well as those without viable alternative project options, were excluded.

The results indicate no direct association between the project to which a student was assigned and their final grade. We also investigated whether teams with a higher proportion of students assigned to their first choice performed better but found no meaningful correlation. These findings suggest that, beyond the intrinsic motivation of working on a preferred project, extrinsic factors and broader contextual influences play a significant role in shaping student outcomes.

Correlation analysis confirms this pattern: interest fit shows only very weak associations with performance, both at the student level ( $r = 0.15$ ) and team level ( $r = 0.19$ ). Neither students nor teams assigned to higher-ranked choices perform significantly better.

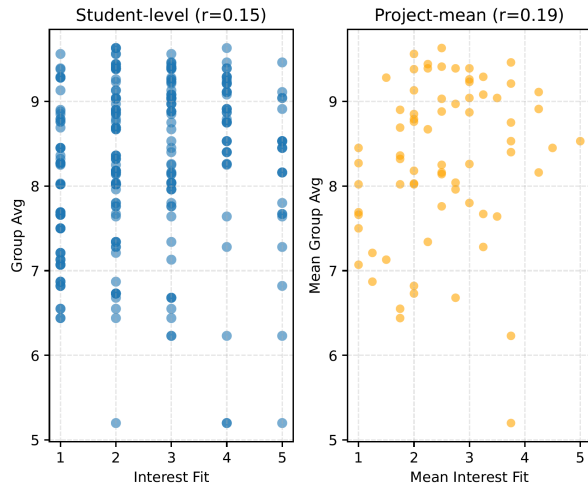


Figure 4 - Relationship between students' project preferences, final project allocations, and performance at both individual and team levels. "Interest 1" indicates that the student was assigned to their first-choice project. Grades range from 0 to 10, with 10 being the highest.

### Conclusion

Capstone projects are intentionally designed as complex, collaborative experiences that challenge students to integrate technical knowledge with professional skills. This study examined whether placing students in their most desired projects influences their academic performance. Across multiple cohorts, the analysis found no meaningful relationship between project preference and final grades.

It is important to emphasize that the assignment procedure studied here does not expose students to projects entirely misaligned with their backgrounds or interests. Even the least-preferred assignments typically involved a student's fifth-ranked option. Although some students express dissatisfaction when not placed in their first choice, and may attribute performance issues to this outcome, the empirical evidence does not support the claim that project preference is a major determinant of success in Capstone work.

While assigning students to projects of high interest may enhance engagement, it does not significantly influence final grades at either the individual or team level in complex, team-based projects.

For program coordinators, the results support assignment strategies that prioritize fairness and balance while considering student preferences without overestimating their impact.

Overall, this study contributes to the understanding of team formation in Capstone programs and reinforces the value of multifactor assignment models. Future work may explore how team dynamics, advisor interactions, and project characteristics jointly shape performance, providing a broader foundation for designing effective, equitable Capstone experiences.

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