ON DESIGNATING STUDENT TEAMS

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Abstract

An essential component of engineering education is the student's experience as a contributing member of a design team. Beginning with the task of selecting teams, the instructor has a range of choices lying somewhere between instructor designation and student self selection. The former technique, which is sometimes random or based on students' grade point average, or similarly rote process, often results in uneven distribution of essential skills. The same happens when students do their own selecting, however much it pleases the superior students to do so. But under either circumstance, team performance in any given class is, in the author's experience, bipolar. Thus educators desire an alternative means to equitably distribute essential skills throughout all teams, while preserving consensus. This paper describes such a procedure, which involves the distribution of short, concise, and 'anonymous' resumes. Both advantages and downsides are discussed.

1. Introduction

In keeping with higher education's emphasis on training undergraduate engineering students to perform in a team-based environment, many papers, on team formation, function, and evaluation, have appeared [cf., 1-5]. Researchers agree that team formation, the very first part of this exercise, is crucial since personalities and skills-mix strongly influence, if not dictate, team success.

The instructor's choice of team formation strategy may be described as lying somewhere between two extremes, instructor assignment, and student self-selection [6]. Prevailing wisdom holds either strategy will lead to markedly bipolar team performance owing, mostly, to uneven distribution of essential skills - machine shop experience, manipulative skills, computer/software acumen, and report writing, for example. In either case, average class performance suffers [7, 8].

As educators are aware, the ideal design-and-build engineering team is comprised of a harmonious distribution of members' traits, both demonstrated and innate, and skills, perhaps including grades, personality types, learning patterns [cf., 9], and/or simply by taking into account students' other, outside-of-class responsibilities [10].

By all accounts, incorporating such considerations helps form a diverse and efficient team and an ultimately rewarding experience, for the instructor as well as the students. The problem,

certainly, is that a good measure of preparation, on the part of the instructor as well as the student, is required in order to implement one or more of the usually prescribed generic team formation strategies. Thus I propose a relatively quick, and anecdotally successful, technique that may be employed in the classroom in about half an hour's time without a great deal of earlier groundwork.

2. Method

First it is noted that a predecessor to the present technique appears in the paper by Saure and Arce [11] who direct their students to write and review generic 'functional resumes' prior to making their own decision regarding teammates. In comparison, the resume described herein is more specific in terms of the at-hand design problem, and it requires arguably less effort to both write and review.

The team selection process begins with an in-class assessment of the specific project's objectives and rules. During such a review, students are encouraged to contribute to the discussion in forming a chalk board list of five or six skills, including generic ones, like leadership, for example, that are essential to a successful project.

Students are then required to prioritize their own prospective contributions to a winning team effort and to write these first four or so skills on a small Post-it™. Along with the prioritized skills, students are directed to write on the Post-it™ an identifier, the last four digits of their student number for example. Finally, the brief, and mostly anonymous 'resumes' are posted randomly on the rear classroom wall.

At this juncture I usually direct the group of students seated in the front classroom row to independently decide which skills among those listed on the chalk board would best complement their own in the quest of a successful design. At the instructor's okay, these students are given a few minutes to skim the posted resumes and then select a complementary partner by removing from the wall their new colleague's resume along with their own.

After the new partner is identified and the pair is given a few minutes to consult with one another regarding the desired skills of an additional team member, the process of selection and consultation is repeated until the full team is formed. Project work may begin immediately.

3. Results

It is noted that the present technique has been used to form successful working groups who historically compete in the annual ASME (American Society of Mechanical Engineers International) student design contest. After winning the regional competition in four of the prior ten years, such teams have scored 3rd, 11th, 3rd, and 2nd, respectively, in the thirteen-team international event [12].

Each ASME student design project generally requires a unique set of skills and/or interests. The 2006 assignment, for example, involved a casting and reeling-in machine designed to be

used by a quadriplegic who wishes simply to sport fish with a rod and reel. Most successful devices, it turned out, operated smoothly as a result of a simple four-bar mechanism, albeit cleverly arranged. In comparison, the following year's contest required the creation of a human powered water purification system, a still, the design of which was, heavily influenced by the thermodynamics of boiling and condensation. In 2006, students' familiarity with kinematics was of primary importance, while an interest in the thermal sciences took precedence in 2007.

4. Conclusions

An obvious advantage is that students are given a direct hand in selecting their own partners while the accumulation of top students into a few elite teams is reduced. And, if the 'resumes' must be referred to later as the project goes forward, these bits of paper serve as a reminder of peer expectations and hasten pressure to perform as promised.

This technique works best when the design problem is well defined. And it is also far more effective when, understandably, students are taken by surprise on team selection day. Thus its efficacy is reduced when used in consecutive terms. Finally, the method has not been evaluated quantitatively, but an effort to do so is underway.

It might be emphasized that no claim is made regarding the better-quality teams that may be formed by this means. Other team selection techniques could quite possibly work as well but the effort required here is simply less than that necessary to implement most of the other formalized and generic team designation processes seen in the literature.

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