

CTFD Professional Development in Teaching Grant Proposal
**Improving the engineering student laboratory team experience
with a focus on overcoming social isolation**

David J. McLaughlin, Professor of ECE

Goals: The goals of this project are to find ways to

1. Improve the performance and effectiveness of engineering student lab teams
2. Use the laboratory teaming opportunity to address the problem of social isolation.

Project Description: University curricula, and engineering curricula in particular, are increasingly emphasizing teamwork as part of the learning experience. Team-based learning is complicated by the addition of social and organizational dimensions to intellectual pursuit. In some cases, these added dimensions enhance learning and the overall student experience; but in other cases, they detract. It is widely observed that some teams perform better than others. We also observe that some students seem to thrive in teams, while others seem to struggle to find team members and to sustain effective collaboration with them. At the same time that some students are struggling to manage their participation in teams, some students also struggle with social isolation. On the surface, teamwork seems like an opportunity for social interaction: a class of 200 represents a theoretical opportunity to meet 199 people, and organizing into teams of four would seem to make things manageable. But an introvert or a new transfer student, say, upon entering a junior-level class comprised of 199 other students, most of whom already know each other, is at a social disadvantage when it comes to assembling into team. *This project addresses team formation and the conduct of teamwork in a large upper-level cross-disciplinary undergraduate engineering class. We aim to find ways to make teaming more effective while at the same time attempting to provide opportunities for students to deal with social isolation.*

Over the past two years we have introduced a substantive hands-on team-based project into a class that had previously been lecture-only. ECE 361 – Fundamentals of Electrical Engineering, is a required course for all mechanical and industrial engineering majors that typically enrolls between 170 and 190 students. We added the lab component as a way to both motivate student interest and cement learning by allowing students to apply theory to practice. The semester-long project involves small teams of 2-4 students working asynchronously to design, build, and test small robotic “smart cars” which they demonstrate at the end of the semester in a class-wide “smart car rally.” A youtube video is here <https://www.youtube.com/watch?v=1tJwOuOdzlQ> and paper about the course, *authored by the students*, is here: <http://asee-ne.org/proceedings/2014/Student%20Papers/207.pdf>

At the beginning of the semester, students are formed into teams and provided with a lab kit which they keep for the duration of the semester. This arrangement seems to work well for most students, and course evaluations are very high: during 2013, “Overall course rating” achieved a score of 4.7 out of 5.0 (standard deviation 0.6) when averaged across the 175 participants in the course. This compares to a college-of- engineering-wide average of 3.5 (standard deviation 0.5) and campus-wide average of 3.7 (standard deviation 0.5). While overall satisfaction and the “buzz” surrounding the course are high, we have the sense that some students are being left behind in the team-participation aspects of the course. At the same time, we also have the sense that some of the students are struggling with social isolation, and we can’t help but wonder whether we can make a difference here by putting more effort into helping the students form and manage their teams. The two hypotheses governing this work are: (1) That team support constructs, such as instructor involvement in team formation, regularly scheduled team meeting times and coaching and frequent check-ins with the instructor, can improve student learning and student satisfaction in their team-based work; (2) That

participation in well-run teams can help students deal with social isolation. The approach we will take is practical: we will diagnose the problem; try to find some practical solutions; implement them during the Fall 2015 run of the course; then assess and publish our results.

Project Implementation:

1. We will first attempt to diagnose the degree to which engineering students perceive that social isolation is a problem. We will do this by interviewing previous students who took the course (there are approximately 360 on campus this semester) and by talking to students and/or staff associated with organizations that support and provide resources to student groups. Among the organizations we will approach are: the Society of Women Engineers (women in engineering), the Stonewall Center (LGBTQIA and Ally groups), Disability Services (people with disabilities), and Engineering Student Services (insights about undergraduate engineering students in general). The key idea here is to use the occasion of this study to meet with people so as to better understand the scope of the social isolation problem in engineering.

2. Review prior literature and best practices and interview students (using some of the same sources discussed above) to better understand the challenges students face when they form and work in teams. Non-traditional students who commute or have family obligations, for example, may have logistical constraints that make their team-work more challenging than students who reside in dorms. Introverts may lack needed social skills. Students from under-represented and minority groups may have different issues.

3. Design and implement support constructs (including meeting schedules; use of google collaboration software, detailed specification of roles and responsibilities, greater instructor involvement in team formation, etc...)

4. Provide mentoring and support to teams thru frequent check-in with the instructor and the teaching assistant team. ECE 361 relies on a graduate TA and a team of eight undergraduate TA's.

5. Establish some non-required opportunities for students to socialize amongst themselves and with the instructor and TA team. This might include, for example, informal group meet-ups for pizza; watching and discussing a movie; Friday "lab drop in night"; etc..

6. Provide a consistent attitude and message that all students are invited and included in the course and the larger learning and living experience. This is an opportunity to act in a manner that is consistent with the campus' Diversity Mission Statement.

Evaluation of impact: Student teaching evaluations provide a built-in mechanism for gauging how the students perceive the impacts. We will aim to design additional questions beyond the standard ones, to specifically learn about student perceptions of the team effectiveness and the impact of teams on social isolation. We will also aim to publish/present a paper on this study, probably at an American Society for Engineering Education (ASEE) venue. And we will seek feedback from faculty advisors and staff in the engineering dean's office and elsewhere about our impacts.

Budget: Total \$3000, allocated as follows:

Pizza for up to 8 social events during Spring and Fall 2015 \$1000

Cost to send 2 UTA's to regional ASEE conference to present paper on this topic \$1000

Support of a student researcher: \$1000