Obtaining Critical Mass and Coalescence in Engineering Technology - Moving an ET Program to a Successful Community

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Abstract

Student retention is a topic often discussed and considered in four year institutions. For program retention it is important that Engineering and Engineering Technology students bond and obtain an identity on campus. Research shows that programs with strong student groups have higher retention rates than those without. New students are able to become acquainted with upperclassmen, to build friendships and to have informal mentors.

Critical mass is a point of change or a situation at which change occurs. For faculty and administrators to obtain "critical mass" in the student body they must help to create an atmosphere where clubs thrive and there is a strong sense of community. They coalesce and can act as a strong and influential single body on campus and beyond. This realization is an important life lesson for students. They become not only strongly bonded to the program but also proud to be a part of the engineering community. They become leaders.

The big question then is how can a university create an environment in which critical mass can be achieved? This paper will discuss the influences that faculty and administration can have on this process by means of a case study at a University where critical mass has been obtained.

From a low of 220 students to a vital student body of 465, this paper describes the process and programs that made the failing program grow to be a success. This was accomplished by applying leadership principles, community building activities, building role models, fostering teamwork, removing boundaries between faculty and students, teaching well, caring for, encouraging and empowering the students. Together, using best practices, the ET Division reinvented itself, became a leader in the university, and doubled STEM prepared graduates who are sought after even during difficult economic times. It is the we, not the I, that is the ET Division.

Case Study / Background

The retention of engineering and engineering technology students has been a concern for years[1]. There have been grant inspired coalitions that worked to keep students interested in engineering, especially during the first year. Design programs during the first year, studies of engineering students and the programs that lead to retention led to first year programs. But many years before all of this action, a freshman seminar series was developed that was the root for the success that will be discussed below[2]. Much of what was funded or written about in the late

1990's and early 2000's was already in place and expanding based on what was thought to be prudent.

The story begins in 1996, starts with a faculty coalescence program that became a faculty/student coalescence program. The program is based on the mentoring model of: I do, you watch. We do, you learn. You do, others watch. We all do, we all learn[3]. The faculty develops into a team and they pass this on to the students. In 2013 the model has been in place for some years and the result is a community that functions well – students succeed and the results are increased student body, more national recognition, and better graduates.

Case Study / Program:

With just 220 students, a faculty that was divided on many issues, and a lack of direction in scholarly and academic arenas, it was the charge of the leadership of the ET Division to get this fixed or have the program relegated to obscurity. Thus the mission for the faculty coalescence was clear: get the faculty working together, encourage them to be scholarly and at the same time, get more students. The first two were the key to the third, and the first two needed to be accomplished simultaneously. Building trust and respect were paramount: the first steps in any leadership situation. The absolute key was getting at least one faculty member to "buy-in" and take on a mentor role for others: basically, install the mentoring model mentioned above one faculty member at a time.

The issues dealing with the faculty direction were associated with tenure which will not be addressed due to their personal nature. Suffice it to say that these were resolved through discussion, reassurance and a focus on the scholarly issues which would, in part, resolve the tenure issues. Thus, scholarly work was addressed. It is important to understand that the faculty was going to be reconstituted with many retiring and others seeking to move elsewhere. Getting the issue of scholarship resolved would lead to a young and vibrant faculty with new ideas and a closer connection with the students. The student issues will be addressed below and it will become obvious how the coalescence happened.

The primary problem with regard to scholarship was the fear of failure. Many of the faculty felt that they had nothing to offer or that they were not capable of writing and presenting at conferences. This was resolved by asking for assistance reviewing a few ASEE papers. The person asked to help was a peer leader and if this person bought in, then the mentor model could be utilized. After reviewing the papers, the response was, "I could do this." And, that is exactly what happened. Papers were written, accepted and published: individually and in small groups. After confidence was gained, more efforts were made and others were included. When new faculty were hired one or two of the tenured faculty were assigned to assist new faculty with their start and before long almost every thought was followed by the comment, "There is a paper in that." Every member of the faculty, who stayed the course, six years, has obtained tenure and universally they feel that the mentorship assisted them in their quest. At least one received

tenure and immediately declared that they never wanted to hear, "There is a paper in that again." The most important outcome was the coalescence of the faculty. Peer mentoring continues to this day with the addition of the concept of, pass it forward. It, in this case, is mentoring. Mentor the students, help them learn how to run organizations, teach them how to lead, how to use time wisely, how to interact with peers and faculty. The goal: build a student body that coalesces within each discipline and across disciplines.

Case Study / Students

We obtained critical mass within the faculty, now critical mass was necessary within the student body. Each discipline had its own professional organization: ASCE, ASME, IEEE. There were also SWE and SAE student organizations; although less active. Each organization was floundering with a half-hearted faculty advisor and students who just wanted to have the organization listed on the resume. With the introduction of faculty who were mentored came the idea of really mentoring the student organizations.

The ASCE student organization was the largest and had the concrete canoe and steel bridge competitions as their potential focal points. Faculty and students took up the challenge and decided to build their first concrete canoe. It was fun, hard work and the first iteration was almost laughable as compared to the current organization. With no idea how to build the canoe, to developing a system that produced 5 trips to nationals in 6 years, the maturation process was hard work. The concrete canoe team was mentored, had feedback sessions, after-action reviews and plans for the next year starting immediately after the annual competition. Student leaders were elected by their peers and an “organization” was developed with subtask leader assignment made to students who were involved the year before. The efficacy of the development of the “organization” is best seen in the “pouring” of the canoe that went from a 12 hour process to a 3 hour process. From raw curing to an elaborate system of pumps and tents to cure and improve strength. The “team” also became interdisciplinary to tap strengths from the EET and MET students. Some of the design utilized computer skills of MET students and the cutting system for the mold was designed by an EET student. The faculty is still involved, but the last “pour-day” was almost totally a student event with faculty dropping in to ensure safety was being maintained.

Similarly, the Baja team opened up to non-MET students and often found students with good mechanical skills. More importantly, the organization and the faculty leadership have improved with better results. The IEEE club, seeing this change in the other clubs moved forward to create a Ham radio station and build an electric car. While the latter are not competitions, they represent organizational development that provides for fun events within the discipline.

There was another result, faculty communication has increased. Faculty talk to each other and trade success stories in an effort to make all of the programs more student centered. The faculty came together to repurpose a small classroom as a student lounge. Here, faculty and students

mix to solve problems, relax and communicate. One outcome that has recently been noticed on the campus is the way in which ET students approach the homecoming weekend: specifically the queen contest. In the past, each of the professional organizations had a candidate: thus, splitting the votes. The leaders of the student professional organizations got together and decided to have a run-off election and put forward one candidate for queen. Each queen candidate is presented to each professional organization during discipline specific seminars and votes are taken to determine the candidate of choice. Once the candidate is selected, the entire ET student body works to get "their" queen elected. Three years and three queens later it appears that they have developed a process that works. Critical mass has been achieved and now the students have another goal: increased representation on the Student Senate. With six members on the current senate include the vice president it appears that ET students realize what it takes to reach critical mass in the governance of the student body.

Recommendations for Obtaining Critical Mass on Other Campuses

Critical mass is a point of change or a situation at which change occurs. For faculty and administrators to obtain "critical mass" in the student body they must start with themselves. "Success begins at the top" is an often repeated motto in leadership and business. It sparks a philosophy that can be used to build a strong and cohesive school in higher education. If the goal is an engineering or engineering technology community on campus with a strong and active student body the faculty must first become a cohesive community. Several suggestions for building strong relations between the faculty members are often cited in articles about faculty success a number of which are discussed below.

Recommendations / Faculty

In the case study the spark was identifying one person that, once convinced, could help get the fire burning. That one person became a scholarship mentor to nearly all new faculty members that joined the school, helping to start them on the right path. The faculty members he helped later became mentors themselves. Mentors can help with scholarship, research, teaching and student relations. Even instructors with experience at another university may see that student expectations are different. This interaction helps the ultimate goal in several ways. First, the untenured faculty and the tenured faculty members are able to develop a bond during the mentoring relationship. Secondly, the "learning curve" for the new instructor is decreased with the aid of their mentor. Another way in which the two faculty members can influence each other is that the enthusiasm of the new faculty member can be contagious and rub off on the seasoned mentor. It is human nature to become complacent or "settle in", being close to a new faculty member can reignite the teaching spark that most young educators have but that seasoned ones often allow to fade.

It is important that faculty members stay positive, professional, and hold onto the common goal; to provide the best possible education for their students. By presenting themselves as a strong

and engaged group, students will see not only their commitment to education but will appreciate their involvement. Creating the perfect environment for critical mass can be tricky but a few suggestions are listed below.

- First, faculty members in the same department (or school if possible) should have offices near one another. In industry, it is common to create "think tanks" where key players are "housed" in the same areas allowing ideas and creativity to feed off of one another. This same idea should apply to academia. Having offices in the same close vicinity, professors will share day to day experiences which will initiate professional relationships and collaborations.
- Faculty should be encouraged to be active in both campus and community service. As students see the faculty, active and collaborating on school and university undertakings, many will come to recognize service as a component of engineering. It is a way for students to make a difference and become leaders.
- If possible encourage faculty outings/rituals. For example once a month meet for breakfast. Emeritus faculty should be encouraged and invited to show the depth of friendship and mentoring, after all we want our graduates to remain active at the university so why not include emeritus faculty.
- Agree to disagree and avoid negativity. Faculty members should remember that they have a common goal; the education of the next generation of engineers. That being said, small differences should be accepted. Discourage negativity and complaining, particularly around students. In a nut shell it is unprofessional, unnecessary and can "sour" a program.
- Some of the most important lessons that we can teach our students are not in the book. Leadership is one of those. By stepping up and becoming leaders on campus the faculty members are teaching by example. Engineers are often, by both nature and training, leaders. A study conducted in 2006 found that there were more CEO's on the Fortune 500 list with engineering degrees that any other degree[4]. Engineers, and engineering faculty in particular, should take every opportunity to be active leaders and, when possible, to enlist the help of students. There are many examples of this at the case study university. Professors run the regional MathCounts, have created Boy Scout Day, and help local high schools with First Robotics entries, just to name a few. All three events mentioned involve cross discipline coordination and student involvement. Even after graduation, students that had helped with projects will maintain ownership and when possible have returned to help with events.

Recommendations / Students

Just like with the faculty, critical mass in the student body requires an initiation. Begin with the club leaders. Encourage the club advisors to spend time with the student leaders. Advisors should get to actually know leaders and build strong working relationships. The clubs clearly belong to

the students but there is much they can learn from their advisors. Emphasis should be on transformational leadership. According to James MacGregor Burns an authority on leadership, transformational leadership is a process in which "leaders and followers help each other to advance to a higher level of morale and motivation"[5] So how should this be accomplished in the clubs? Yukl, a researcher in leadership gives the following five steps[6].

1. Develop a challenging and attractive vision, together with the students.
2. Tie the vision to a strategy for its achievement.
3. Develop the vision, specify and translate it to actions.
4. Express confidence, decisiveness and optimism about the vision and its implementation.
5. Realize the vision through small planned steps and small successes in the path for its full implementation.

Again, as with faculty, creating the perfect environment for critical mass in the student body can be tricky but a few suggestions are listed below:

- The student leaders should be mentored by their predecessors. If clubs vote on new leadership in December or January the “retired” leaders are available as mentors for the first semester. It is also helpful if the club leaders have interested underclassmen attend officer meetings since they will be the next in line.
- The mentoring/leadership process described helps students to bond across disciplines and years. It helps to create an environment where sophomores, juniors and seniors are working together.
- To build a cohesive student body it is also important for communication, collaboration and pride to exist between disciplines. For example, students in ASME should know and work together with students in ASCE and IEEE. Having student offices near one another or requiring events where all clubs must work together are helpful. For example, have clubs collectively plan and execute a fall “kick-off” picnic and a spring barbecue. At the fall ‘Kick-off” party clubs can display items to help with enrollment. For example the Baja Team can have the car available. Try to hold the event where all engineering students and faculty can easily attend.
- Help students to see that the engineering clubs have the same objectives and that what is good for one group is good for all the groups. For example, after several student groups experienced a reduction in the amount awarded by the student government. The students realized the importance of having representation on student government. The clubs relied on the power of the enrollment numbers in the engineering school and campaigned for their candidates. As a result five of seven open positions on student council are now held by engineering students.

Closing

Enrollment in a scholastic program flourishes in an atmosphere where the student body and its clubs feel significant and important. But, obtaining the needed environment requires leadership on many levels. The administrators must encourage and support the process and the faculty members must coalesce by mentoring and supporting each other as well as the students. Once the faculty and administrators have formed the needed bonds, the student body can thrive through the empowerment that comes from forming a critical mass.

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