Building Community through Clustered Courses

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Abstract

The Dwight Look College of Engineering typically enrolls 1400 to 1700 starting freshmen each year. The majority of these freshmen take their first-year math, science and engineering courses as a cluster. A cluster is a collection of approximately 100 students who have the same schedule for a group of three or four courses. These courses have some overlap in (or connection between) subject matter.

Each course uses a teaming concept, with engineering dividing the students into teams of four, and math and science using lab partners. Since team assignments are not necessarily consistent between courses, a student may work in teams with several students from within the cluster who are not part of their engineering team. Consequently, even though the freshman class as a whole is quite large, common course scheduling and the use of teams within individual courses promote the development of a small community atmosphere.

There is much evidence of this community effect:

1. student progress towards completing key freshman-level courses,
2. the development of friendships between students and formation superteam study groups, which include members from several individual course teams,
3. the choice of students to continue clustering into upper level courses (requiring they take initiative to establish a clustered course schedule), and,
4. improved student retention for several cohorts.

Moreover, since student attitudes about teaming and academic assistance are more positive with course clustering, students are generally more satisfied with their first year experience in the college.

This paper examines the impact of community building on student interaction and attitudes as related to cluster. In addition, it evaluates faculty perceptions and experiences with clustered courses.

History of Freshman Clustering at Texas A&M University

The Foundation Coalition was founded in 1993 with a mission in part to improve engineering curricula and learning environments in which engineering students are taught. At Texas A&M University, Foundation Coalition programs included clustering students during their freshman year. With clustering (Table 1), students take their mathematics, science, and engineering...
classes within a cluster of up to 95 other students. Clustering results in these students having the same class schedule. In addition to scheduling, syllabi for clustered courses are integrated so that material covered in one class reinforces material presented in companion courses within the cluster. Further, most clustered courses involve students in active and collaborative learning environments, which feature student teams. Clustering was piloted at Texas A&M University in 1994 with approximately 100 students. In 1998, clustering was instituted for all freshmen.

Table 1. Course Clustering Options for Freshman Engineering Students

<table>
<thead>
<tr>
<th>Semester</th>
<th>Subject</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>Engineering</td>
<td>Foundations of Engineering I</td>
</tr>
<tr>
<td></td>
<td>Math</td>
<td>Engineering Mathematics I</td>
</tr>
<tr>
<td></td>
<td>Physics</td>
<td>Mechanics</td>
</tr>
<tr>
<td>Second</td>
<td>Engineering</td>
<td>Foundations of Engineering II</td>
</tr>
<tr>
<td></td>
<td>Math</td>
<td>Engineering Mathematics II</td>
</tr>
<tr>
<td></td>
<td>Physics</td>
<td>Electricity and Optics</td>
</tr>
<tr>
<td></td>
<td>Chemistry or</td>
<td>General Chemistry for Engineers</td>
</tr>
<tr>
<td></td>
<td>Engineering</td>
<td>Foundations of Engineering II</td>
</tr>
<tr>
<td></td>
<td>Math</td>
<td>Engineering Mathematics II</td>
</tr>
<tr>
<td></td>
<td>Physics</td>
<td>Electricity and Optics</td>
</tr>
<tr>
<td></td>
<td>Chemistry</td>
<td>General Chemistry for Engineers</td>
</tr>
</tbody>
</table>

Progress on Key Freshman-Level Courses

Freshman engineering students at Texas A&M University are required to complete 27 credit hours of fundamental courses. These courses include eight hours calculus, eight hours of physics, four hours of chemistry, three hours of English, and four hours of introductory engineering problem solving. Students must obtain a grade of C or better in each of these courses before they are allowed to take higher level courses in the engineering department of choice. As shown in Figure 1, FC programs featuring clustering of first-time freshman starting in 1998 resulted in greater progress towards completing the 27 hours of required fundamental courses during the first year.
Figure 1. Average number of required fundamental course hours completed with an A, B, or C grade during the first year.

Since FC cohorting programs were institutionalized in 1998, clustered students have progressed through these required fundamental courses more quickly than their non-clustered peers. Students starting in 1998 and 1999 who were clustered during both semesters of their freshman year completed the required courses in 3.6 semesters. By contrast, students starting in 1998 and 1999 who were in non-clustered courses for both freshmen semesters required 4.1 and 3.7 semesters, respectively. Although the 1999 clustered students completed the courses in essentially the same amount of time; the 0.5 semester decrease seen for the 1998 cluster does indicate a significant benefit of clustering. Future students will be tracked to see which of the two groups is more representative.

Establishment of Friendships within Clusters

Interviews with faculty participating in clustered courses explored development of friendships among students. Faculty were asked the questions:

Did the students start helping each other with activities outside the classroom?
Did they start studying together for exams? Did they become friends?

Overall, faculty believe that students generally formed friendships within their clustered courses and that cohorting the students facilitated development of friendships. In addition, professors felt that students worked together away from the classroom. However, faculty were not able to identify the depth of friendships formed through clustered courses.

On a separate occasion, one faculty member participating in the freshman engineering course recounted her experience with friendship development among students. During the semester she taught the course, one of her student teams demonstrated substantial friction. The problem...
became sufficiently severe to require the faculty’s intervention. The following semester, the faculty had a chance meeting with some of the team members and discovered, much to her surprise, that the team had moved past their prior friction to become good friends. Even after completing the course in which they were assigned as a team, these students chose to stay together for study and social purposes.

Voluntary Clustering in Following Years

Formal clustering was offered to students during their first four semesters as a part of the 1994-1998 Foundation Coalition pilot program. Although formal credit for participation in coalition classes stopped after three semesters in the Electrical Engineering curriculum, a group of 10 EE students (from the coalition class starting in fall of 1995) continued with their coalition buddies throughout the second year, and continued to participate in clusters throughout their stay at Texas A&M. Each semester, they would arrange with the academic advisors in the electrical engineering department to be enrolled in the same sections of required courses, often they also would select the same electives, and sometimes even take courses that would not count so that they could stay together.

Development of “Superteams”

The use of teams in clustered classes also has led to a survival strategy we call superteams, groups of students that incorporate members from several teams as assigned in clustered courses. Superteam formation is purely voluntary and likely is the result of the amount of contact students in clustered courses have with one another. At first, these superteams were an attempt to thwart faculty imposed (typically at midsemester) changes in team assignments. In this situation, superteams formed as students worked with their new teammates as well as with those from their previous team. Some of the students would simply drag their new teammates to continued meetings of their old team -- where these new arrivals would discover that some teams really did function as study groups, work on work from other classes, etc. Superteams occur often in clustered classes (possibly due to the greater exposure of the students to their classmates), but rarely occur in unclustered classes. When present, they have contributed greatly to the camaraderie of the students and the general environment in the classroom.

Retention

FC programs including clustering were joined with those of the Texas Alliance for Minority Participation (TXAMP) to retain the talented freshmen that entered the engineering program. The impact of the new FC curriculum was explored in conjunction with the TXAMP program’s intervention strategies, bridge programs, clustering, mentoring efforts and other retention strategies. Results from 1994 through 1998, shown in Figure 2, indicate that the best practices from both of these programs resulted in better retention of all students in engineering. Results of this investigation led to adoption of these programs for all engineering students starting in 1998.

Since systematic adoption of clustering in 1998, student retention was typically higher for students taking clustered courses. As seen in Table 2, first time freshmen who took clustered courses both semesters were retained at significantly higher rates (especially for 2\textsuperscript{nd} year
retention) than those students who took courses that were not clustered during the same semesters. This trend was not observed for first year retention of freshmen starting in 2000 (2nd year retention is not yet available for these students). By coincidence, students starting in 2000 in non-clustered classes had both higher SAT scores and high school ranks than those in the clustered classes (1300 versus 1245, and 95.9% versus 90.6% respectively). Observed retention for the 2000 freshmen may indicate that clustering is most beneficial for those students with lower SAT scores and high school rank, however, additional research would be required to confirm this.

![Retention comparison chart](image)

**Figure 2. Retention of first year freshmen in traditional and Foundation Coalition curricula, 1994 through 1998.**

**Table 2. Student Retention as a function of clustering**

<table>
<thead>
<tr>
<th>Cohort</th>
<th>1st year Retention</th>
<th>2nd year Retention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998 not clustered</td>
<td>84.2%</td>
<td>73.7%</td>
</tr>
<tr>
<td>1999 not clustered</td>
<td>83.0%</td>
<td>72.3%</td>
</tr>
<tr>
<td>1998 clustered</td>
<td>90.7%</td>
<td>85.7%</td>
</tr>
<tr>
<td>1999 clustered</td>
<td>92.9%</td>
<td>84.4%</td>
</tr>
</tbody>
</table>

**Faculty Perception of Clustering**

Overall, faculty and student participants in the clustering program at Texas A&M University feel clustering provides benefits within and beyond the classroom. Although not solely attributable to clustering, the following comment is typical of faculty teaching clustered sections:

*I had the best class that I have ever had this semester -- they just seemed to click and form a very pleasant group of students who "hung in there" the entire semester.*
Other members of the instructional staff in the freshman engineering course share this opinion of clustering. The instructional staff includes an upper division undergraduate student who serves as a peer teacher. One peer teacher, who had previously worked with clustered sections, quit following a semester with an unclustered section (on the possibility she may be assigned to another unclustered section). Another faculty member echoed the same sentiment:

*I never want to teach an unclustered group of freshmen again!*


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Ann Kenimer is an Associate Professor of Biological and Agricultural Engineering at Texas A&M University and a member of the NSF Foundation Coalition project. She teaches courses in engineering problem solving, engineering design, environmental engineering technology, and nonpoint source pollution control. She has received two college-level teaching awards and is a recent recipient of the ASAE A. W. Farrall Young Educator Award.

JIM MORGAN
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