

This interview with Bob Gustafson (Associate Dean for Academic Affairs and Student Services, College of Engineering), John Merrill (Assessment Consultant, College of Engineering), and John Demel (Professor of Civil and Environmental Engineering and Geodetic Science) of Ohio State University, took place at the University of Clemson on March 20, 2001.

Susan Ledlow: Let's start by asking, whoever is the most appropriate person, to give a brief overview of your freshman programs. . . . Bob, do you want to begin with how all of this got started? . . .

Bob Gustafson: Well, certainly. Our freshman programs really entail two different tracks: one is our Freshman Engineering Honors Program—which involves twenty-five percent to thirty-five percent of our students—then, our Introduction to Engineering sequence—which encompasses all of our students now at this point, if they're not honors track. The Freshman Engineering Honors Program has been really a product of the Gateway Coalition Project, and it's been developing and scaling up over quite a bit of time. In this past year, for example, I think we had two hundred and fifteen students start in the program this past fall.

. . . Our Introduction to Engineering sequence, which is now two quarters—three credit courses each quarter for all of our engineering students—also started this past fall. Both of those introduced more engineering; up-front, hands-on . . . laboratory components; and a lot of introduction to basics in communications and initial skills in engineering.

Ledlow: Why the emphasis on teaming? There seems to be a lot of teamwork among your students and among your faculty. How did that develop?

John Demel: A lot of that came out of the surveys that we did of our own graduates out in industry . . . and their managers. What they told us was that we needed to have teamwork as part of the undergraduate program, and so we try to incorporate teamwork in exercises in classrooms. Every hands-on laboratory that they . . . [perform], they do in teams, and when they do their design projects, they're team-designed projects.

Gustafson: I think an additional element, if you look at what makes students successful, is really trying to promote retention. [It] is early bonding of student groups, early ability to work with other students—these are very important too. So building the teams early is an experience [that] really helps them be successful as students, as well as successful in practice later on.

John Merrill: We also had several examples from one of our senior professors in mechanical engineering who was engaged in multi-disciplinary projects as part of the senior capstone design project. I think seeing the success at the senior level caused us to reflect on what could be done at the earlier stages of the development so that the students were even better prepared to participate in those kinds of projects.

Ledlow: How do you get training for faculty? I would imagine a lot of engineers [would] say, "Yeah, I know how to teach engineering, but I don't know about how to do this teaming and cooperative learning stuff." Did you have formal training workshops? How did you get them started?

Merrill: Well, we're certainly still evolving as far as development for faculty is concerned. We have had individuals like Karl Smith on campus to help with collaborative learning workshops, so we're very much keyed into that. With the Intro to Engineering program we actually have a couple of team workshops that we provide for the students. Right now, Bob and I do those primarily. The other faculty is there, and they observe, and they participate; so, in some sense, that's kind of a development activity for them. They're not directly involved in putting on those workshops right now. However, throughout the course of the quarter, they are responsible for ensuring that their teams are working well together on their projects, that the teams are successful, and that they provide guidance or intervention when necessary. It's more like an ad hoc thing, where we work with faculty through weekly team meetings. As team issues come up, we address them in that format.

Gustafson: I guess particularly critical in our format too . . . we have a team of instructors that involves not just a faculty member but teaching assistants, graduate students, and peer mentors/undergraduates. Often our peer mentors and teaching assistants are on the front line of making these teams work. They need some additional skill building and support in . . . how to do an intervention, when to do it, when not to do it, and how to seek a productive outcome.

Ledlow: Would you explain a little bit more about what you mean by peer mentors, because I'm not sure everyone would use that term in the same way that you do. What's a peer mentor?

Demel: Well, we've found that the undergraduate student communicating with other undergraduate students really works pretty well. The freshmen will ask questions of other students more quickly than they will of the graduate students or of the faculty. So we have a program where juniors and seniors who apply are interviewed, and then we [may] choose them to be the peer mentors. The concept has been good enough that Honda of America has endowed this program with a million dollars so that we can pay our peer mentors.

Gustafson: The peer mentor program is very interesting. We do have a peer mentor with each section—with each thirty-six students—that will follow them through the basic instruction . . . and the laboratory part. I know this past quarter was just fascinating to me to see my two peer mentors work with their kids. These are juniors and seniors, but they have really adopted that group and really bonded to them. They really invested themselves in the success of these first- and second-quarter freshmen. It's fun to see.

Ledlow: Would you say a little bit more about the extensive coordination you have among faculty? I think that idea of weekly faculty meetings to plan teaching strategies

is pretty unique. You wouldn't find that on a lot of campuses. Is everybody willing and excited about coming to this meeting? How did you get “buy-in” for this idea?

Merrill: Well, I think the people who are faculty in this program are the ones who are very interested in teaching, and, also, they're interested in freshman development. So, they're willing to make that extra effort to come to another meeting and really look at what's going on that week . . . and just to process the challenges that we encounter on a week-to-week basis.

Demel: We do have a common syllabus. We have up to seven sections of the same course, so we'll have seven instructors. One of the ways of keeping everything working together is actually having those weekly meetings. That is where the faculty and graduate students bring in questions for tests. They are reviewed . . . in those meetings, so everybody can make sure they are covering the material that needs to be covered during that particular block of time. We really started the team meetings early on, when we started putting the program together for the honor students. We would have math and physics involved along with engineering. If we were going to coordinate what we were doing in the engineering courses with what was going on in math and physics, we had to sit down fairly often and it ended up being a weekly meeting.

What we find now is that half the time is used in coordination, and half the time is used in discussing the student's progress. When we see somebody doing a great job—they are finally getting into this course—or someone is having trouble . . . one of us knows the student well enough to get them over to the right person to get help. Also, we've seen [that] as we set grades, and someone has done reasonably well in two courses and is struggling in the third, we might cut them a break in the third course so they can keep participating in the program. So, there are a lot of things that go on in that cooperation.

Merrill: I thought I might add . . . we do a lot of ongoing communication throughout the week, just by e-mail and faculty dropping into the program office. But the meetings themselves, I think, just provide a forum for people to see each other. That helps to maintain esprit de corps.

Ledlow: You say you have seven sections, but across these seven sections are there similar criteria for forming teams? Doing teambuilding? Keeping teams together for the same length of time? Could you talk a little bit about the process of setting student teams?

Demel: In the freshman and junior honors program, for the first two quarters, we reset the teams each week when they go to the hands-on laboratory. What we're trying to do is get these students to meet each other and learn to work together in a relatively short time. . . . [Teaming] is really on a random basis with no real intent of mating/matching certain personalities, learning types, genders, or whatever. . . . In the physics class they are actually assigned to learning teams for five weeks. Then their teams are changed for the second five weeks. There they actually have a chance to build and work as a

team. In the physics program they go to lectures or large-room activities as a team and respond to collaborative learning. They go to recitations where they actually work on problems. The GTA, the graduate teaching associate, is simply a facilitator. And when they go to the hands-on labs in physics, they are challenged to create their own learning in those laboratory environments. Probably the interesting part is they have two midterms. In each midterm eighty percent is done by the individual and twenty percent is done by the group. They get a very complex problem that they have to break down and solve, with individual components they have to put back together, and turn in the answer. So teams are done in a variety of ways.

Merrill: In the Introduction to Engineering program, which is a two-quarter sequence, we form the teams into two, five-week blocks. So with any given quarter the students experience being a member of two different teams in the first course. In the second course they are part of a team for the whole ten weeks. So, it's a ten-week, design/build project. We do try to balance the teams out by gender and, if possible, by field of specialization. Not that they are really specializing yet. But if they have declared an interest in civil versus mechanical, we try to mix them up, so you don't have one team where you have all four people with a mechanical orientation.

Gustafson: I think it is critical here too that we—during introductions—try to give them some instruction on teamwork, try and put a structure together that supports that teamwork, and allow them to give feedback to each other, anonymously, through a Web-based system. So, they start out with basic instructions of what a team looks like; they will do a written team agreement; they'll do feedback—an evaluation of their own team performance. It is really trying to get them to go beyond just being a group . . . to being a team—helping them structure and function as a team.

Merrill: As he mentioned, we have an on-line assessment tool where the members of the team can anonymously provide each other with feedback. Let's say all three or four members of the team complete the questionnaire. The report is automatically sent to each member of the team as a composite . . . “Well, this is what my team thinks about my contributions, my willingness to be a team member, whether or not I have been punctual for team meetings, and so forth.”

Demel: There is a component there, in those surveys or assessment forms, where they talk about technical competence, as well as teamwork aspects. For some students it brings them to reality that they aren't as good as they thought they might be, and for other students it gives them the boost that says, “Gee, I didn't think I was that good, but this is how my teammates see me.” That is really important for the growth of each one of the students in the process.

In the honors program for the engineering course it's the physics professor who actually creates the teams. We allow the students to choose a certain number of people from that particular section to be on their team. . . . “These are the people I would like to have on my team.” We also give them the opportunity to say, “Here are two people that I have found I just can't work with over the last two quarters.” Again, we try to balance

talents, so if someone is a good writer, if someone is good at oral presentations, if someone is good at programming, if someone is good at building things—then we try to put together teams that are relatively even across the seven sections. So, in the honors program for the ten-week team design project, we'll have thirty-six teams of approximately three to four students each.

Ledlow: How do you, as faculty members and program staff, get involved if there are serious team conflicts? What is the process if the student comes to one of you and says, "I hate my team! Let me off." How do you deal with that?

Gustafson: We struggle with that—it is one of the most challenging things. We have not allowed teams to fire anybody yet; although, I've had some teams that really wanted to do that, particularly this last quarter. We have worked with them and tried to get them to communicate . . . do some written contracts . . . those sorts of things. . . . We still had one team [that], at the end of this quarter, three out of four members of the team said that one member didn't contribute. It does affect their grade at the end of the class, so there is some end result of non-collaboration in the group that they are all aware of.

Demel: We begin working with them at the beginning of the ten-week, team-design/build project to create a teamworking agreement that addresses things like, "How are we going to make decisions? Does it have to be consensus? Is it majority rule? Exactly how are we going to make these decisions?" We try to make sure that, in their design schedule, that each one of them knows very clearly what their responsibilities are, so they can't say, "Well, gee, I didn't know that!" And we also try to have them use this team assessment form around the end of the third week and around the end of the seventh week. Now, those don't count for the final grade, but it lets the students know . . . "Gee, they don't think I'm working hard enough," or, "They perceive that I'm trying to do the whole thing myself." Of course, we are not interested in one person doing everything for the team, nor are we interested in someone just watching. We really do want them to work together as teams in the process, and the working agreement is the important point. Beyond that, it is listening, you know, when someone comes and says, "We've got a problem with our team." We try to listen and talk to each one of the individuals, then we get the team together and talk about things. This is a hard thing for the students to do when things are not going well.

Gustafson: John, a good example of that was a student I had this last fall quarter who came to me with just that concern. And she said, "I think I'm really the problem. I want everything done exactly, perfectly—my way. How do I do this team thing?" So, it really was an awakening for her. It was one of those "Aha!" moments. . . . It was a teachable moment at that point.

Merrill: I might add that I think the students know that they can go to the faculty, the TAs, or the peer mentors if they have concerns, as an individual or a team member. Some of the TAs have come to me asking, "What do I do if this team is not functioning well?" I said, "If you ever need me as a neutral observer in a discussion when you are trying to resolve something with the team, I'm more than willing to be there." Actually, it

has not been necessary this year. They have been able to work things through on their own.

Demel: When we form teams, sometimes we have three or four students that nobody wants on their team . . . and we have put them together. Sometimes, we call them the “team from hell.” Surprisingly enough, they then put aside all the things that have been a problem and accomplish the task. Not without a few sparks, a little friction—but it does happen and even they learn how to work as teams.

Ledlow: You’ve alluded to grades a few times. How does grading work in the team environment? What sort of ratio of group to individual grades do you use?

Merrill: I would say we place the majority of the final grade on individual performance. That’s about a sixty to forty ratio. Even with the assignments that are team based, we provide a final weight that gets calculated into the final grade. In other words, the team contribution does have some bearing on those projects which were team based.

Demel: In the honors program, in the first two quarters, there is probably twenty-five to thirty percent that is team based. In the third quarter, where it is the team design project, there is really only one grade assigned at the end of the quarter . . . per team. And then that is distributed by how the team members evaluate each other in terms of who should get the credit . . . and how the credit should be distributed. I think everything in that quarter is one team grade. There are weekly reviews, weekly performance . . . deadlines that have to be met. That all goes to the team, not to the individual.

Ledlow: In that environment, when you’re basing everything on a group grade, how do you ensure individual accountability within the group? If they are not in the classroom and you are not monitoring them, how do you know that one person didn’t do all the work? Or how do you ensure some sort of individual accountability for that?

Merrill: I don’t think we can insure that it is going to work—in the ideal sense of being a fully functioning team—in every case. And that is part of the process, though, because they know we can’t be fully aware of who is doing every single aspect of a project, or how they have broken it down, and who is being accountable on an individual basis. But that is part of the process of being a responsible individual as a member of a team. And I think, in one sense, that is hard to measure, but it is certainly a lesson that has to be learned as far as being a team member is concerned.

Demel: In the first course, in the honors program, they work as teams on all the hands-on laboratories. But at the end of the quarter, we have a lab practical exam that is done on an individual basis. So, if they have had to build circuits, or build gear trains, or analyze electric motor performance, or any one of the tasks they are expected to do, they will be expected to be able to do that again on an individual basis at the end of the quarter. That helps to keep some of that individual accountability in the process.

Gustafson: Really, working in teams, that kind of accountability is not terribly different from what you get individually. When you are collecting homework or exams from individuals, you see challenges there. I think when you use some of the good collaborative learning techniques . . . you can really enhance that in the team. For example, when you are doing team reports, you'll say, "I'm going to randomly select a team and then randomly select a person within that team to do the report from your team. So you have to ensure that everyone in your team can do this." You can really have them teaching each other in more directed ways.

Merrill: I'd like to add to that we have team-based projects where [students] make presentations. At the end of the quarter, for example, there might be an oral presentation, as well as a demonstration of something they have built. So, if they haven't functioned as a team, or if there is a third or fourth person on the team who has not participated, it becomes pretty evident pretty quickly to everybody. Most students don't want to take that risk. They want to look good.

Ledlow: Let's get into in-class versus out-of-class [teamwork]. How much teamwork goes on in class? What is a typical classroom day like in your freshman programs?

Merrill: Well, in our one large seventy-two-seat computer classroom, we have the teams situated at tables that encourage individual work as well as small group discussion. We have these custom-designed tables that seem to facilitate that. The students meet in that environment approximately three hours a week. Some of the time there is allotted for working in small groups, apart from a presentation that might be made by a faculty member. The labs are all team-based. The majority of the time is based on team-based activities. Now, how much time they are able to find outside of that to work on a team, which we certainly encourage them to do, really depends on the motivation of that particular team. . . . Also, to some extent, to their geographical location on campus and how they are able to get together physically. So they also rely on e-mail and perhaps a bulletin board to communicate some of their progress.

Ledlow: In your program do you use any pre-designed cooperative learning strategies like Jigsaw, Academic Controversies, Think-Pair-Share, or Formulate-Share-Listen-Create? Do your faculty use those sorts of designs in their teaching?

Demel: Some . . . we're learning. And there are some things that each one of them has done over the years that they, probably, have not done in every one of the five to seven sections of the same course. We are working on getting more of that kind of thing going on in the classes. In our physics classroom for our freshman engineering honor students there are actually demonstrations. And then the students discuss what the physics relationship is or what the physics equation would be to describe that particular activity. . . . Then they discuss that in class and share it. In engineering, we are just not that far along yet to have, I think, enough orchestrated team activities—the Think-Pair-Share kinds of things.

Ledlow: If you are not using something that someone else has designed, how do you design a good classroom, or out-of-class, cooperative activity? What is the process? Do you do it all together? Does every section do it individually? Or is it a combination of that and do you share what you have with each other? How do you sit down and plan an activity for next Monday?

Demel: Well, Bob mostly did the ethics modular, and that incorporated some case studies . . . where, I think you [Bob Gustafson] had students work on that . . . but it was delivered by each one of the faculty in that particular case.

Gustafson: Right. Recognizing that, in our program, we are trying to deliver a pretty standardized curriculum by a multitude of different persons . . . we have tried to be fairly prescriptive of what we want in the content and approach. The ethic module is a good example where we have taken some basic content—we looked at some case studies, we've used a basic construct for looking at a moral dilemma. . . . But then having these students, in groups, identify the parts of the case study—do that as a group and then have sample reports . . . then we can actually go out on the Web and use some NSPEK cases and things like that as well.

Demel: But, you were the one that developed the material, Bob. . . . We talked about it in the weekly meeting. People got the materials distributed to each member of the faculty, and you actually walked the faculty through one of the case studies. . . . I wasn't at that particular meeting. . . .

Gustafson: We talked about how we wanted to approach it. We didn't actually do the example. With some of the other elements of instruction, usually one of the faculty will take the lead for a certain segment of the curriculum and do the development on that. Then, in the weekly meetings, do some kind of training sessions for the TAs, peer mentors, and the other faculty. For example, if we are doing some exercises in CAD [computer-aided design] key . . . [we'd] say, "Fundamentally, here's where we are going to go. . . . Here're some of the problems you can expect to see" [We] work with them as students, to get through it . . . and then do the preparation; and, of course, then [the faculty] add their twist to it when they are doing their own sections.

Ledlow: Bob . . . I know you said that you call on people randomly, and that is a good way of insuring individual accountability, but do you ever do other strategies like assigning roles when you are doing team activities?

Gustafson: I think several of our faculty have had experience in their own classes using collaborative learning techniques. We have been relying on those [techniques] and people to help us in curriculum design. They may take a chunk of the elements—for instance, the graphics part, the ethic's part, the teamwork part, the MAT lab part—to build that. And it's an interim process. . . . We keep trying things that we are going to be adjusting as we go on, to see if we can refine some of those activities. . . . Now that we have got a space that really facilitates collaboration, we're just on the edge of really being able to blossom into that. We're just trying to take advantage of that now.

Demel: I don't know if we've said this before, but when the faculty sign on to teach these freshman courses, and they come from the various departments, we have the graduate students and peer mentors in for something like a four-day workshop before the quarter begins. The faculty comes in for two of those days, so we have them actually walk through the program we are going to cover. We talk about learning styles; we talk about collaborative learning; we talk about these things and get them involved. But we are still learning—there is a lot of learning to be done yet, and, for us, a lot of coordination and cooperation. Because we want the faculty who teach in the freshman program to turn over, so over a period of years we'll have twenty to thirty percent of the college's faculty having taught the freshman programs.

Ledlow: Let's talk about the impact on students and faculty. This is a process, as you said, so let's start with how is your faculty reacting?

Merrill: I would say, by and large, very positively. They see it as an opportunity to do something different, to break the mold. They enjoy working with the freshmen. . . . They find them to be very energetic and enthused. It just gives them a change to do something a little bit differently. So, it is challenging them to modify their teaching styles as well and to put more responsibility on the student as far as their learning is concerned.

Gustafson: I think a good representation of that is recently having a couple of juniors come by the class and stick their heads in, and say, "Why didn't we get to do that when we were freshman? We didn't get to see that until later on!" I think it is a good reflection that we are doing things right.

Demel: Up until now we didn't have a formal faculty-development program for the college. So having faculty come in and be part of this faculty training for the freshman program, we finally have, in effect, a faculty-development program that we are testing. Now we are moving into a more formal faculty-development program for all the new faculty, and any of the current faculty that want to participate. That should be online by autumn quarter of this year.

Ledlow: I like what Bob said about the reaction of the students. You're also getting some stats [statistical information] that would indicate that this program is really doing a good job in those things you're concerned about. Do you want to talk about that a little bit?

Merrill: We've gotten a lot of narrative information from the students in reaction to the first workshop we did on team development. And again, by and large, it was very positive. The comments ranged from, "This is great! It got me thinking about the importance of communication skills," to the other end of the spectrum where somebody said, "What, are you kidding? Do you think we are socially inept?" In other words, they thought it was at too low of a level or we were insulting their intelligence. That is challenging to us, because we have to think about, "What are the notions that students

bring in? What is their background? What are their abilities to be involved in effective teamwork?” I think, by and large, they are capable, but they may not necessarily have the skill set. And that is why we provide this workshop format to help them be successful as a team member, as we place demands on them throughout the quarter.

Demel: One of the other sort of anecdotal parts is the students go to interviews for co-ops or internships. When they sit down and talk about what their experiences have been in our freshman programs, the people from industry are really impressed that they have done all these things. Of course, that is how we planned it from what industry gave us, so it isn't a surprise to us. But it is a surprise to them that they can interview very well—then, the success of getting co-op or internship positions in the process.

Ledlow: And some of your stats that you are improving student retention in the program—do you want to say a little bit about that?

Merrill: I would say, for example, with the introduction to the engineering program, which started as a pilot two years ago in the autumn of '98, we carried ninety percent of those individuals into their sophomore year—which sounds incredible, unbelievable, etc. How can that be? A lot of them had a positive experience as a freshman, so they came back as a sophomore. That did not necessarily carry through to the junior year. That initial group, again, was a small . . . sixty-eight-percent retention. That is still almost twenty percent above historic averages. We have seen that carry through into the second group, also, as they have become sophomores. We are doing the longitudinal tracking, and we are seeing a definite impact. I think, with the honors program, the statistics are even higher. Of course, you are starting with a higher caliber of student, but they definitely are being retained at a much higher percentage.

Demel: Traditionally, the honor students, or those who were calculus ready, were staying in engineering at about a seventy percent rate to graduation. With freshmen entering [the] honors program, we've been tracking those students. If they have participated in the program for two quarters, we get at least eighty to eighty-five percent retention. If they participate for three quarters, it is between ninety and 100 percent retention to graduation. So, we've even taken the better ones and improved the retention with those. The combined retention should be up at least fifteen to twenty percent for our new first quarter freshman for the university. And . . . that's why we got the money from the dean.

Gustafson: I think one has to be careful just to look at the raw statistics, too, because one of our objectives is to help these students find where they belong. Finding out they don't belong in engineering could be just as positive of a result, in getting them where they do fit in the university, before they get discouraged and get into academic difficulty in some cases. It's very important to us too [for them] to succeed in the university, even if they are not a match to engineering. So, that is an important objective that I think we are doing a better job of as well.

Demel: We had a young lady come into the freshman honors engineering. She did a great job. Her grades were good and so on, but you could see that when she came to class, she wasn't particularly happy. Towards the end of the second quarter she walked in and she was smiling. She came up to me and said, "I wanted to let you know what I am going to do. I always wanted to be in early childhood education and elementary education, and I'm going to switch. And I said, "Great!" I think she finished in about three years and two quarters, rather than the full four years. And she is very happy going out to be an elementary ed teacher. I think it will be great, because, yes, she is very competent in math and science, and many of the elementary teachers are not. So, now we are going to have somebody who is really good at math and science working with young students. What could be a better outcome?

Merrill: I might add, of course, the jury is still out—we have not had, at least with the intro program, one group that has actually reached their senior year and graduated yet. So, we don't know what those numbers are going to look like. But as the programs mature, I think it is interesting to note that we have students who have gone through the program coming back and wanting to work in . . . the ongoing program as a peer mentor or as graduate students.

Ledlow: The final question I would like to ask each of you, in turn. If a faculty member came to you, either on your campus or another campus, and said, "I want to try experimenting with teaming," what advice or words of wisdom would you give that person?

Demel: Go to one of Rich Felder or Karl Smith's workshops. That would be the first step. Then take a look in the literature and find out who in their particular discipline has been doing this, so they can pick up some of the group activities. Look at a modified syllabus for how this was incorporated into the course. Probably, work with whoever was creating those materials, sort of as an on-campus or long distance mentor, so when they ran into problems, [they could ask], "Gee, we started this and the students didn't respond. Now what do I do?" So, I think you really need an ongoing resource. However, you really ought to go to a workshop, which is not only about collaborative learning but is done in a collaborative learning style. And it helps to establish in your mind how this should go.

Merrill: I'm going to borrow something from Bob here and build on that. Understand what your philosophy of teaching is and what are your assumptions about learning. And, also, be prepared to do a fair amount of work. Because it is . . . very time consuming, at least initially. But I think the benefits definitely far outweigh the investment.

Gustafson: I would add just a couple of things to that. One, try it, but don't jump in all the way. Try some early things with . . . just more limited sorts of things . . . and try it early in the term. Because students, in that first couple of days, get a sense of what the style of the course is. If you try and change it dramatically later in the term, you're going to have problems. . . . It just seems to work that way. And I think the students are good

teammates in doing that too. If you let them know what you are going to do and get feedback on it, they can be very helpful in developing the instructor's ability to do these exercises.

Ledlow: Thank you all very much.