

This interview with Ronald J. Roedel, Professor of Electrical Engineering at Arizona State University, took place on the campus of Arizona State University on January 25, 2001.

**Susan Ledlow:** First, two questions together—how long have you been using cooperative learning and why did you start?

**Ronald Roedel:** I've been using cooperative learning for approximately seven years now, and I started because of a seminar that I heard given by Karl Smith, [a] professor from the University of Minnesota, who stated unambiguously that he had a better delivery method for education, a better experience in the classroom for students; and I thought I would give it a try.

**Ledlow:** How have your students responded to cooperative learning?

**Roedel:** I have to admit it was a little bit difficult for me to switch over to cooperative learning, because the focus in cooperative learning is not on the professor any longer. And I'm a bit of a ham; I like to entertain people as well as educate them. I had become a very successful lecturer—a person who could dazzle them in the classroom. So I had learned how to be a very effective lecturer, I believe, who got a great deal of material across and helped students learn a great deal. To try to go to a new teaching method was difficult, so I was prepared for a large reduction in my teacher's evaluations. I was prepared to see students say that they weren't getting as much from the classroom experience with cooperative learning as they were in the previous format. But having said that, I was surprised to learn that even after the first semester, students warmed up to this method quite rapidly. And I believe that when properly applied, cooperative learning is perhaps the most effective way of getting students to learn the material.

**Ledlow:** How did you learn to do cooperative learning? What was the process for developing those new skills into your teaching?

**Roedel:** As I mentioned previously, I first was exposed to it through a seminar given by a Professor [Karl] Smith from Minnesota. Professor Smith has written extensively on the matter. He conducts workshops, so I attended a few of those. I read his texts on cooperative learning. I read other materials by people who carry out cooperative learning. And then I discovered I wasn't the first one at ASU to think about cooperative learning. There were other resources on campus for me to learn. There were "brown-bag lunches," for example, from the Center for Learning and Teaching Excellence that I attended, where people who were learning how to use cooperative learning were sharing their experiences informally. Then I met some other people in engineering who had been trying it. I spent a great deal of time learning from them—chatting with them, meeting with them formally and informally, observing their own classroom styles and procedures, and then taking in all that information, synthesizing it, and adding my own stamp to it.

**Ledlow:** Do you explain to your students why you are using cooperative learning?

**Roedel:** Yes, I do explain. I must say that I use it both at the elementary levels of the university experience—freshman and sophomore classes—as well as [in] upper-division classes. Seven years ago or so . . . when it was still a relatively new phenomenon in the engineering school, I would have to explain to every group of students why I was going to employ this strategy. Now that it has become much more commonplace at ASU and in the engineering school, I find it necessary only to tell the freshman—and even then just briefly because they have heard about it or seen it themselves in their high school classes. The upper-division students at ASU are quite familiar and, for the most part, quite comfortable with it. All I need to say these days, especially for the upper-division classes, is that we are going to use active or cooperative learning strategies in this classroom, and that’s it. And they’re prepared to go.

[With] the freshmen, who may not know about cooperative learning, I do need to spend more time describing why we do carry out cooperative learning rather than have a traditional lecture. I try to explain to them that the process of learning and working in teams is analogous to how they will probably find themselves working in the workplace when they leave the university. Since they are engineering students, most will go on to work for engineering firms—like Motorola or Honeywell—and there teamwork is the norm. It is necessary to learn how to become part of the team, because the projects that one works on outside the university are far too complicated for any one individual to accomplish. The training that they get through team learning will apply immediately to the teamwork that [they] will have to do in industry, but it also has additional pedagogical benefits, too. They will become better learners. . . .

**Ledlow:** How do you form teams?

**Roedel:** I should also point out, certainly in the freshman classes, I work with a team of professors. So we, as a team of professors, put together the teams of students. In the upper-division classes where I work by myself, I use some of the strategies that I have learned from the undergraduate, lower-division classes in the upper-division strategies, too. There is a great deal of literature on how to form teams. We’ve reviewed immense amounts of it. There is also a great deal of inconsistency in the literature on how to form teams, so we have tried an enormous number of different approaches. But what we have seemed to find work best for us is putting students together primarily by schedule and location. By location, I mean where they live. We want students to work together when they leave the classroom—in the evenings, between classes, on the weekends. And we find that if students live in the same proximity—if we can put together teams of students who live in the same dorm, or in the same part of the community—so that they don’t have to commute immense distances to meet each other—then their out-of-class meetings are much more likely to occur and far fewer problems are likely to occur. Believe it or not, we think that proximity is one of the most important considerations. We don’t think it is too important to have student teams with a spread of grade point averages or a spread of other scientific skills. They seem to all share those equally anyway.

We have tried different strategies with involving minority and female students. [We've tried] to put just one [minority or female] student in with a group of white male students or to put two in, so that the one student doesn't feel he or she is singled out. We have even tried putting together student teams of all four women or all four minority students. The students don't seem to mind too much in the engineering classes what sort of form they are in. In fact, they prefer if their grouping is random. At least that is the feedback we get when we ask them . . . what their impression was of the team and how well it performed.

**Ledlow:** Do you use teambuilding activities?

**Roedel:** We use quite a few teambuilding activities, and we concentrate them, of course, at the beginning when the team is first forming. We describe to them what kinds of stages they can expect the team to go through. [It] is well documented in the literature that teams begin in a honeymoon period, then they begin to have conflicts, then they need to resolve these conflicts, and then, finally, they begin to work well together, and they actually act like a team. Their performance at first may start to be inferior to individual efforts, before they actually learn to work together successfully. So we show them they can expect that, and then we show them strategies on how to get around some of the conflicts. We try to put them through some exercises on how to build camaraderie, how to demonstrate to each other that they are stronger as a team than [as] individuals, that they can work out their conflicts readily on their own. We have a series of ten or twelve different teambuilding exercises for them to use.

**Ledlow:** Is there one you particularly like?

**Roedel:** The one that is particularly useful, and the one that I make sure that they learn well, is based on the feedback that I get from the students. The biggest conflicts they have are students not showing up for meetings prepared. That always causes friction . . . [and] arguments, and then it sometimes spirals downhill from there. So the most important skill we try to teach them is constructive criticism, where they can use minor intervention techniques to get around some of these meeting conflict problems. . . . For example, instead of, "You're constantly late for meetings. This is annoying!" they can say, "There must be something wrong with our meeting time. Maybe we can pick a new one." So they learn how to attack the problem without attacking the offender. If that fails, then we show them that there are ways of being gentle when talking to an offender. "When you're late for a meeting, I feel this way or that way because it causes me to do this or do that." So we make them go through that role-playing a little bit, to see how they might feel if put in the position he or she puts the other students in. And that usually works pretty successfully.

**Ledlow:** Do you select the communication skills and team skills that you're teaching because you feel they're important to developing teams of engineers in the work place? Are these skills transferable into the real work world?

**Roedel:** I think some of the team skills and some of the conflict resolution skills we try to teach the students are useful in the classroom, in the workplace, and at home. I tell them that I use these same conflict management skills with my wife, not always successfully, but . . . they're human skills . . . they can be applied to any human endeavor, I believe.

**Ledlow:** Now that you have your students in teams, and they're all comfortable and communicating effectively, we're going to talk about what you actually do with them in the classroom. To start out with, when and under what circumstances do you choose to use cooperative learning, rather than another teaching strategy?

**Roedel:** Well, there are many forms of cooperative learning, and there must be ten different models for cooperative learning. And, I believe, the people who like [cooperative learning] the best, are the ones who take what they think are the best practices, blend them, synthesize them, and then add their own flavor or spin to it. What has worked extremely well for me is to blend a little bit of lecture with a lot of cooperative learning. Normally, what I'll do in a class period . . . I'll usually begin—I think they call this the Bookends method—with a small lecturette—five minutes, maybe three minutes—just setting the stage so that everyone knows the direction I want them to go. Then I will assign a task that needs to be done in class by the students themselves. I'll check for understanding to make certain they know the direction I want them to go. They will work on this for ten, fifteen, thirty minutes—whatever the appropriate period is. We'll stop. I will call on teams at random to report what they've got. Then I'll be the Greek chorus, and I'll comment on what that team has done, and on whether I thought it was successful or unsuccessful, or if it could lead to something right, or if they are going down the wrong path. And then perhaps [I'll] show a few more hints, some suggestions, some paths and directions to follow. Perhaps ask for other students' comments at this point and then let them work some more. Then, finally, [I'll] wrap up the class again with another little lecturette to produce closure, so that students don't walk out of the classroom thinking, "Well I worked on it for thirty minutes or forty minutes, and I have no idea whether I have made any progress or not." I want them to make sure that they start the class with a clear understanding of something to be accomplished that day and end the class with having felt that they have accomplished something correct that day. Or at least as correct as I think it might be. So that is my general approach . . . I have to modify it depending on the material and the students. It is slightly different timing with upper-division classes, perhaps a little more lecturette, a little less classroom work. More at the lower-division classes, while I want them to discover more. . . . I will let them work longer on problems, but the format is basically the same.

**Ledlow:** You have mentioned the Bookends Lecture, also known as the Interactive Lecture, and that is one strategy. There are other pre-designed strategies like Jigsaw or Academic Controversy. Do you use any of those pre-designed strategies?

**Roedel:** I've used Jigsaw a few times, but I'm not happy with that method particularly. In the Jigsaw method, where a group of four students separate, find four parts of some

problem, and come back and report to each other what they've learned, I find that each student becomes a specialist in that one area, and they know very little about the rest. I don't know if that is the right way to do things in an engineering class.

**Ledlow:** What about simple strategies like Think-Pair-Share?

**Roedel:** Yes. Think-Pair-Share is especially good at the upper-division material where I want students to immediately process some point. I'll mention some derivation in the classroom, and I'll ask everyone to look to [his/her] partner and comment on this, "What would have happened if I had put a plus sign here instead of a minus sign here? What would have happened if I had raised the temperature instead of lowering the temperature? Talk about it for two minutes, and then we will discuss that." So I think Think-Pair-Share is a brilliant way of bringing students into the dialogue.

**Ledlow:** When you are not using something pre-designed like Think-Pair-Share, and you're planning the group activities that you are going to be doing in your classroom, how do you go about planning them? For example, do you assign homework or readings to encourage preparation? Do you always use roles? Do you always have written instructions to students? What do you do to make a lesson a good team activity?

**Roedel:** That is an excellent question. I think it all starts with a learning outcome that I want. Of course, there are learning outcomes for the entire class, but then there are specific learning outcomes for specific days. So I start with that. I'll decide, for example, today is the day the students are going to learn Euler's method of numerical integration on an Excel spreadsheet. Once I have that outcome in mind, then I think of a problem that could be applied to that. So we will have them integrate Newton's Law of Cooling to find how long it takes a beer to chill from room temperature to drinkable temperature. That usually works well—to bring alcohol into the classroom (at least the thought of alcohol into the classroom). Then I show them on the spreadsheet how they may begin with this. I don't show them the process or details; I say, "Here is a strategy that might work." Then I let them go to it. So it's ordered, it's scripted. I make certain that I don't go in there and [think] up a problem on the minute without having worked it myself. I make certain that the problems are indeed workable, that they have solutions, and that they have solutions that can be achieved in a short period of time—or at least enough headway can be made in the classroom that they can then take that work with them and use it as homework or the basis for some more extended project later.

On occasion—actually very often—I have students read about some particular topic, some particular piece of material ahead of time. Of course, they have a textbook, there are readings in the textbook, [and] there are homework problems assigned from the textbook. But, normally, the classroom period doesn't rely heavily on the material in the textbook, except as a starting point for something.

Basically, the class preparation is involved. It takes a little more time because I have to try to be a little more creative than I do with the lecture mode. Having done it for some

time now, it is becoming second nature to me, and, so, it is taking less time to prepare than the lecture process.

**Ledlow:** When your students are working on these team projects, what are some ways you ensure individual accountability? How do you know that one student didn't do all the work?

**Roedel:** Yes, that's the sixty-four dollar question with teaming. . . . There is some cooperative work that is done in the classroom, and it's just that piece of work for that day, and it's finished, and we move on after that. Then there is cooperative work, like the projects that you mentioned that may take a student six weeks to accomplish. I'm a little more concerned that students contribute equally to the longer projects than I am on any given day, whether one student is the leader today and slacking off the next day . . . in the classroom. So when it comes to the projects, I have some ways of monitoring this.

First of all, I observe what the students are doing, and I look to see if it appears [that] the student teams are working with everyone sharing more or less equally in the work. If there are three people actively engaged in front of a computer terminal and one student reading the campus paper, I stop that instantly, saying, "This won't do. Join in." Or if the student is doing some other work, like calculus homework, instead of working with the team, I say, "This is not time for calculus, this is time to work with your peers here." There are little things like that.

Then I also expect the students to police themselves and to bring everyone into the fold. I also expect the students not to allow anyone to become the team czar or leader. I want them all to say, "No, that's not allowed. You can be the leader today, but not the ruler in perpetuity." I hear from the students that they manage that reasonably well.

The final check is twice during the project—halfway during the project and at the end of the project—I ask the students to assess themselves. Each student is given a figure—\$40,000 and they are to divide that \$40,000 among themselves, pretend it is a salary. And if they are all working equally, they assign to each of themselves \$10,000, and they have to write a little justification. Each student has to do this and they often do it anonymously so that there is no collusion or no hard feelings. They get to do this knowing that I'm the only one [to] review this. I have found that remarkably consistent results emerge from this. The students tend to be quite honest about it. In teams where there are two or three students out of four who are working very diligently on the project, and one student who is just not pulling his or her weight, the three students will say, "We all did great, but Johnny here just didn't show up for meetings, didn't come prepared, and he really doesn't deserve the same salary that we did." And then Johnny himself will write, "I probably didn't pull my weight the way I should. I was busy with work or I had some family issues." He'll make up some excuse, maybe a legitimate one. But he'll say, "I'm sorry I just didn't do what I should have done. I don't deserve as much either." So there is great consistency. Then I use sort of a weighted scale. I use that division of money in the final grading formula. It may demote one student from a

“B” to a “C,” or an “A” to “B,” depending upon how severe the problem appears to be. I do that in the middle of the project and let them know if there is any problem, that they should work on correcting it, or if there is anything I can do to assist, I let them know I am available for that. Then I see if there has been any progress by the time the project is finished.

**Ledlow:** That brings us to the issue of grading generally. The use of group grades is a source of friction for some people. Would you talk about how you use group grades, and how you use individual grades? Along with that, do you grade everything they do in class, or are you only grading the group project?

**Roedel:** There is an individual and a group component to the grade. It varies from class to class, semester to semester. I don't think I have settled on the ideal balance yet. At the lower-division classes, [it is approximately] thirty-three percent individual and sixty-seven percent group. Since group grades tend to average many high points and low points, the grading in the lower-division classes is quite uniform. Students have to do quite poorly to get “C's,” “D's,” and “E's” in my classes. “A's” and “B's” seem to be kind of common. In the upper-division classes, I'd say the split is closer to the other way around two-third individual, one-third group grade. In the lower-division classes, I don't give examinations per se. There are homework assignments; some of those are team assignments, some of those are individual assignments. The assignments may be analytical or they may be a writing assignment to describe something related to the practice of engineering, a report of some sort. Find the names of four famous engineers and describe what they are doing these days, [engineers] whose names are commonplace . . . something like that. That, I make an individual assignment and give a grade based on both the writing and the content. There are homework sets, mini projects, and large projects to do in the lower-division classes. The approximate division of all the work is two-thirds is based on projects and one-third [is] based on homework sets. I also leave a little room for classroom participation or anything else that seems to come up. [With] students who seem to have extra initiative, I'll just keep that in mind. If they are borderline for no good reason, I'll give them a better grade. But I'd say the projects are entirely group and team work, so everyone gets the same grade there, but then modified by that numerical weighting from their own internal assessment.

Individual grades are individual grades. I do give them this one sort of hybrid piece of work to do in the freshman engineering class. They have some assignments to carry out in which they work in class on a modeling problem where they have to carry out some work on an Excel spreadsheet. I want them all to work on that together, come up with the same model. But then they all have to turn in an individual report . . . where they have to define the problem, set the stage for the problem, give an introduction to it, list what was expected from the problem, define certain new terms, and show how these new terms or concepts related to the model we've carried out. Then they all have to describe the model, and they have to come up with conclusions about the success of the model, and so on, and the result of the problem they are trying to solve. So they all work together on a portion of that—the model, the analytical portion—but then they all have to write an individual report on that model. They can not share any information on

that. So that blends a little bit some individual and some group work, which is actually very much like what I do when writing a technical paper or proposal. I get pieces of information from others that I've worked on and blend it in to a report that has my own writing at the beginning and the end. So I want them to learn that that is also how you may work at industry or academia or elsewhere. Sometimes the work is not clearly just individual or just group; it's a blend. So I have that in there as well.

**Ledlow:** Managing your classes is different when you switch to cooperative learning. How is it different for you? Do you use any management strategies, like team folders, class management software like Blackboard, or e-mail?

**Roedel:** The first thing I had to learn, when moving from the lecture mode to the cooperative learning mode, was that the classroom environment experience was very different. In the lecture mode I was the only speaker, and the rest of the class had to be as quiet as doormice. Now, in cooperative learning, students are talking out loud, they're talking to each other, they're talking across the room, they're getting up and going around, sharing information. So the management of the classroom was first internal. I had to learn to get used to the noise level being higher. I also had to learn how to justify to administrators walking by that, "This isn't chaos; this is organized, believe me."

The second thing was that I had to learn how to get around quickly from team to team. My class this term has twelve teams in it, and, in every fifty-minute class period, I manage to get to each of those teams at least three times per period. So I don't spend a lot of time with each team, but I make sure that I communicate personally, one on one, with each and every one of the teams to make sure that they understand what we are doing, they're making progress on the problem, they're keeping abreast of the situation, etc.

I've been teaching all of my classes from a Web page for the last five years. . . . I normally put [all my] classroom materials [on the Web]. For example, [when we cover] demonstrations of an Excel spreadsheet, I'll have on the Web page a link to a spreadsheet that demonstrates some technique. Any lecturette, in the Bookends method, is presented on PowerPoint slides that I have on the Web page. The Web page also has all the other information about the class—my syllabus, week-by-week schedule, links to other important areas, my schedule, announcements, and so on. . . . I have not demanded that the students turn their homework in to me by the Web, but they can. Very often I will ask them to turn in the final projects and reports on a Wednesday and some students will just hand me a slip of paper saying, "Here's the URL where you can find my project." They warm up to the Web, too. So I'll just put a link from my Web page to their Web page to show the world, "Here is what Team Four's final project/report was like." . . . Teaching from the Web is useful to students who . . . can look at it ahead of time or . . . refer to it at later times.

**Ledlow:** You only briefly mentioned conflict within teams. How do you react if a team or team member comes to you and says, "My team is awful. We are having problems.

Johnny is not doing his share of the work.” What is your responsibility for getting involved in that?

**Roedel:** Well, I first ask them to try and work out the problems themselves—not because I’m trying to pass the buck, but because I think people ultimately have to live with themselves and with their friends, and they are the ones who have to learn how to make this human connection correct. I ask the students to come to me if they think some of the intervention skills they have tried have not been successful, and we have meetings in my room. We’ll have wide-open discussions about issues, responsibilities, punctuality, preparedness, maturity, etc. And sometimes that works. If it doesn’t work, I let the students know these teams are not permanent. We re-align them twice per semester. It is not the end of the world . . . make the best of it. Then we will reassign and maybe the problem is not Johnny, but Johnny is trying to fit in with you, and maybe Johnny will be a better student if placed somewhere else. And maybe you students in your next assignment will get a team without a Johnny. But you have to recognize that not all humans do get along, and you have to sometimes just stick with a difficult situation and make the best of it. I don’t know that I have been all that successful in trying to resolve conflict within teams, but I have given it a good shot and the students have walked away saying, “Thank you for having tried.” Several times in the past, [the Foundation Coalition instructors have] had all teams come into the office, just to ask them pointblank, “Are there any problems you haven’t told us about? Are there any problems you are afraid to bring up with us? Are there any issues that you would just like to discuss in general about how this course is being delivered, about life in general, about the practice of engineering, about the Phoenix Suns? Is there anything that you want to talk about that you are afraid to talk about or uncomfortable talking about either in the classroom or [because] you don’t care to e-mail us?” Usually nothing profitable comes from those meetings. The students are shy or reluctant to talk to us and probably for good reason. We are not particularly good counselors; we’re not trained in it. We’re just trying to share some experience we have with them. But the students all appreciate the fact that we’ve tried and walk away thinking, “These professors care.” So I think making that effort is probably more meaningful than what might actually come from it. We do try.

That is one of the true benefits of a cooperative learning approach . . . that the students can see that the professors are actually interested in their learning. In the lecture mode, there is no way of knowing if the professor is actually interested in you. It appears that the professor is more interested in himself or herself or being a grand public speaker or wonderful orator. In the cooperative learning method—in the team method—I think the students recognize that it is all teamwork. We’re all trying to get ahead in this world, and we’re all trying to help each other. I think the students see that.

**Ledlow:** Let’s talk a little bit about class size. Can you do cooperative learning in any size class? If so, how does a large class differ from a small class?

**Roedel:** I think there is no limit to the size. Let me take that back. There may be a lower limit. If you only have four students in your seminar, it would be difficult to do

teaming. One team and they all turn in one paper. No, I think in large classes it works as well as in medium sized classes. . . . I think the Think-Pair-Share method was shown to be very successful in lectures of five hundred students. . . . You can immediately engage everybody with that. I don't think there is an upper limit. I think I mentioned a few minutes ago that I have twelve teams in my current class, and I manage to get to each of them three times per class period. When that number gets up to sixteen, or twenty, or forty teams, I can't get to all of them per class period without an assistant. I think you need an assistant or another instructor with you in the classroom, when the class gets large enough, if you want to have that personal interaction with each team—and I think you should.

I think teaming—whether you use teaming or not—depends on the particular engineering class. I don't use teaming at all in my graduate-level classes. I stick there with primarily lecture mode, although I do use Think-Pair-Share and a few other active learning strategies to keep the students engaged. But graduate student format and graduate learning outcomes are different than undergraduate student learning outcomes. So I think cooperative learning works absolutely the best at the freshman- and sophomore-level classes and is still profitable at the upper-division classes, especially those classes that have projects—design projects, some complicated piece of work that is too involved for one student and takes a fair amount of time. That is when I think getting students to learn and work and think as teams is most profitable.

**Ledlow:** Some concluding questions. As you've gotten more skilled as a cooperative learning teacher, what has changed? Are you still doing the same kinds of things as when you started or what has been your development through cooperative learning?

**Roedel:** When I began, I tried many different approaches. I wanted to see if I could tick off, in my classes, all the different kinds of cooperative learning approaches like Jigsaw and Academic Controversy and so on. I've reduced that set to the Bookends method and the Think-Pair-Share. I think those are the only two that I substantially use now, and I think they have worked the best for me. Professor [Karl] Smith from Minnesota says, "That's right, Ron. Not every approach is meant for every class and for every instructor. Use the ones that you like the best."

I did violate one of his rules. He said, "Start slowly with this." I tossed out everything and went into it right away, and that may not have been a good idea, but that's the way I am—impulsive. I've reached a steady state, and I'm comfortable with it. I like the approach I'm using. My teaching evaluations have never been higher. I exceed the teaching evaluations from the ones I used to get as the pure lecturer. So I think I'm doing the right job, based on that feedback.

I always felt, in the lecture mode, that I was the one learning the most in the classroom. I feel now, in the cooperative learning mode, [that] I still learn a great deal when I'm in the classroom, because I still have to prepare, organize, and think about the material, but I think the students get more from each classroom period than they used to in the past. I haven't abandoned entirely the lecture mode. I still like to use portions of it in

small doses, and I try to be effective with it. I want to make certain, when working in teams, students don't veer off on a tangent or go the wrong direction. End up proving Newton was wrong, for example, or [that] Einstein was nuts. These people were probably correct, so let's make sure our results are consistent with theirs. I want to make sure that the class ends on a note that is correct, so I try to put an effective wrap-up lecture at the end. So I still get to use some of my old lecture classroom skills.

I do believe that . . . I've become more efficient at [cooperative learning]. It takes me about the same time to prepare for a cooperative learning class period as it does with lecture class period. And I'm quite comfortable with it; I'm glad I went this way.

**Ledlow:** If another engineering faculty member came to you and said, "I'm thinking about trying this cooperative learning," what advice would you give to them about getting started?

**Roedel:** I would say that there are plenty of resources today to learn. The first thing you should do is sit in one of my classes or sit in one of Greg Raupp's classes or sit in one of Susan Ledlow's classes . . . to see how somebody who is practiced at it actually carries it out. See a variety of different people, so you can see different approaches and look for the ones that resonate with you. The ones that you think look the most effective, the most fun to try, are probably the most meaningful in your own classroom. And then there is information on the Web, there are textbooks; there's [an] immense amount of literature on this. You can read until you get dizzy on this issue. Do some reading, do take a look at other people trying it, and give it your own spin and get going.

**Ledlow:** Final question. Could you share some of your best experiences with cooperative learning?

**Roedel:** I've had quite a few. I can't think of a day when I had a lecture so great that the people stood up and applauded, but I can think of many days in the cooperative classroom where the students demonstrated the projects they built and all cheered and applauded themselves at the end of that. I can't pick a specific one, but I can say there have been many successes—especially related to the students' successful completion of involved projects that are successful, which they could not have carried out in any mode other than the cooperative learning mode.

**Ledlow:** Any final thoughts you want to share?

**Roedel:** Let me say this. There is some question as to whether cooperative learning is a fad and will soon evaporate once the beauty of the lecture process or some other pedagogical delivery scheme emerges. And all I have to say is that, yes, sure, maybe there are still even better approaches. One of the hallmarks of teaming and cooperative learning is that it [builds in] the continuous improvement process. If you . . . find other strategies that work, then you are allowed to bring them in. All I can say is that I believe I am a much more effective teacher now with the cooperative learning method, and I thought I was a very effective teacher beforehand. I believe there has been a step up in

my productivity and my ability to help students learn, and it is not a technique I intend to abandon. At least, I don't intend to retreat to the lecture method. It is probably the most worthwhile thing I've done in my twenty years of being an educator.