

This interview with Russ Pimmel, Professor of Electrical and Computer Engineering at University of Alabama, took place at Clemson University on Monday, March 19, 2001.

**Susan Ledlow:** How long have you used cooperative learning?

**Russ Pimmel:** Probably about five years, six years.

**Ledlow:** Why did you start?

**Pimmel:** We had the Foundation Coalition there [at the University of Alabama], and they had some people come in and give some workshops on it, and I went and listened. I wasn't a convert at first, and [I] just thought about it for a while and started doing a few things. What really got me was, when we were doing our senior capstone course, of course, nobody wanted to do it; and we had to have it, so we decided to put some professional skills in it—communication, ethics, design methodology, and so on. I'd never done anything like that before, so I went out and did the usual thing—got a bunch of material, packaged it, and lectured, and dumped it on them for fifty minutes. And everybody was bored, including me, and they weren't learning very much. So I thought, "We've got to do something different." At that time we had the cooperative learning people coming in, so that's how I got started.

**Ledlow:** How would you compare your experience using cooperative learning with traditional lecture?

**Pimmel:** Let me give you one example. I normally teach our junior-level course in digital systems, which is a big course—sixty to a hundred students a semester. One semester, we made major changes in it, and I thought, "It's time." I decided to put cooperative learning into it. At the same time I was teaching a senior course in computer design [using traditional teaching methods]. About halfway through the semester I was enjoying showing up for the one class—the junior-level class—and I was bored in the senior class. Halfway through the lecture I'd say, "I've got another twenty to thirty minutes to talk, and this is boring!" So that's how I got involved in it, and that's how I would compare [traditional lecture versus cooperative learning]. It was even boring for me to go for fifty minutes talking.

I think the students react a little better [to cooperative learning]. I know that when I was teaching the skills courses, they seemed to respond a lot more positively. . . . I don't think [the traditional course] had as much of an impact on, for example, their presentation skills. I don't think at the end of that course, back when I did it the traditional way by lecturing for fifty minutes, that they had acquired as much skill as they do now. I think that's because now they're involved in thinking about guidelines for good presentations.

**Ledlow:** How did you learn to do cooperative learning? You said you went to a few workshops to start. What kinds of subsequent things did you do to learn new ideas?

**Pimmel:** I didn't have a lot of input—we had a few people on campus. Reading a little bit, looking on the Web a little bit, but mostly sort of evolving on my own. . . . There's PIGSFace [Johnson, Johnson, and Smith's principles of cooperative learning] that people talk about, and I sort of knew what those five items were. As I watched what I was doing and how I was working, I evolved a lot of these same ideas myself. If I got started ten years earlier, I would've been one of the godfathers, but now I'm a Johnny-come-lately.

**Ledlow:** What skills did you need to develop as a teacher to be effective using cooperative learning?

**Pimmel:** You have to learn to be a lot more open to students. You have to learn to watch and understand what's going on and try to figure out what they're doing in their minds. You have to learn how to teach teaming skills, what these are and what they mean. . . . You have to learn how to create assignments that are appropriate for a team activity. So those are the big things—an attitude change . . . how to teach teaming skills, and how to create assignments that fit into a cooperative learning activity. Then you've got to be adaptable—pay attention to what you're doing, what you see, what students say about it, and then figure out what's wrong and how to fix it. So you've got to be self-critical.

**Ledlow:** We'll talk more about how you develop lessons in a minute. Right now let's move into setting the climate. Do you explain to your students why they're using cooperative learning?

**Pimmel:** I've done that. There's an article by [Richard] Felder that talks about the improvements he observed. So I show them a little of that data about how grades have gone up, how attitudes improved, and so on. I don't spend a lot of time on that—five to ten minutes. I also talk about the importance of teaming and show a few things—employers' lists of skills that we look for when we interview, skills that we use when we evaluate employees. . . . Teaming is always very high on that . . . so I use that for an argument. I even use the ABET [Accreditation Board for Engineering and Technology] guidelines as an argument sometimes to justify it.

**Ledlow:** What methods do you use to assign teams?

**Pimmel:** All kinds of methods. When I first started, I was using the big auditorium classroom. It was in-class exercises, so wherever they sat, that was very informal and ad hoc. In the computer engineering course, I have them fill out a form where they indicate their schedule. They check off Monday, Wednesday, Friday—morning, afternoon or evening; Tuesday, Thursday—morning, afternoon, evening; Saturday, Sunday—morning, afternoon, evening. Then, [they write down] their grades for the two requisite courses. I try to match them up in rank order from their three time choices, so that they have two times that overlap and so that their grades are balanced: an "A" student with a "C" student with a "B" student. So that's how I do it.

I teach the capstone course sometimes, and I let them pick there. I let them pick, not by “I want to be on your team,” but I give them a list of projects, and they pick the project they want to be on. They list their preferences, and I sort them out that way. Again, trying to balance a little bit, if there is opportunity to do that. More often than not, it comes out you’ve got four people who want to do this and four people who want to do that, so it just works out nice. They’re not picking [by] “I want to be on so-and-so’s team.” They’re picking the project they want to work on.

**Ledlow:** Do you use formal teambuilding activities with your teams?

**Pimmel:** Yes. Again, in the auditorium classroom I spend five minutes talking about how you do it, a couple of times. In the senior computer course, when we start the project, I spend half the class going through some of the ideas on teaming. In the capstone design course we spend several days going through team training.

**Ledlow:** Could you give us an example of a teambuilding activity that you like or that works really well?

**Pimmel:** Some of the things I do are some of the traditional stuff like The Telephone, where you try to write down all the symbols on a keypad. You do it individually, and you do it as a team; and if you get the symbols perfect, you get a point, so you can get twelve points. They usually score one point, two points, three points better as a team. And the other ones are the ones everybody uses—the survival ones—Lunar One and the Airplane Crash. Those are okay.

The ones I do a lot are, for example, when you’re talking about the Code of Cooperation for your team, what I’ll do is have them start by identifying items that bother them. They’ve all been on teams before, and I’ll ask them, “What bothers you about being on a team? What are behaviors that bother you?” So they do that individually, and then I’ll have them get together as a team [to] create a list of five things that bother them as a team. . . . And then I talk about Code of Cooperation, “What you need to do now for your assignment is take five things and convert them into positive statements for your team.” That’s worked pretty well.

The other thing is we talk about meetings. I have them list, “What are the things that make meetings effective?” . . . Then [I] come back and show them some of the guidelines for meetings. I do the same thing with presentation skills, writing skills, and design skills. That’s how I approach it: have them do it first, think about it.

**Ledlow:** Do you explicitly teach communication skills like active listening or constructive criticism or checking for consensus?

**Pimmel:** Not in any formal way. We do talk about listening skills. . . . I have done the exercise where I have them list things that would get in the way of listening and then go through one of those lists to show . . . the things you do if you want to be a good listener. They think they’re good listeners. They’ve sat there in class for, at this point

four years, listening to lectures, and they think they really know how to listen—but they really don't.

**Ledlow:** What sort of skills do you think that students ought to be getting before they graduate and go out and actually work as an engineer?

**Pimmel:** Well, there's a whole list of them. Part of our problem is, in all our classes, it's a pretty homogenous mix of students. [There is] diversity of skills and a little bit of diversity in personality and social background, but in terms of work background and academic background, they're carbon copies. They come out of the same machine, so they really don't have that experience of working with people who have different languages than them. That's one thing that would be missing.

I would like to see a lot more [emphasis] on just about any of these skills. . . . I don't think we do a very good job . . . even with things that people really think we do, like problem solving. . . . Given the project out of context, most students will stumble around and not know where to start.

**Ledlow:** When you're planning your lessons, when and under what circumstances do you choose to use cooperative learning, rather than some other teaching strategy?

**Pimmel:** If I'm writing a regular course, digital systems or computer architecture, I just plan on building in [cooperative learning activities] periodically—two or three per lecture—and so when I get to the end of a topic, I'll stick an exercise in there. When I'm doing a transition, I'll put something in there to get them involved. Like I say, I'm a real believer now, and ten minutes is a long time, twenty minutes is a real long time, and fifty minutes is beyond infinity.

**Ledlow:** Is preparing for cooperative learning different than preparing for straight lecture?

**Pimmel:** Yes, it is in a way. . . . I believe you do sacrifice some content. So you've got to pick more carefully what you put into a course. I think you've got to structure it a little bit in smaller bites. You have to think a lot about what your real objective is. I've sort of always done that, but I think some people don't. They sort of just say, "This is what I want to talk about," and they just talk about it, and they don't have a clear idea of what they want their students to be able to do at the end of that period or lecture.

So if you have that idea, I think that [using] cooperative learning is pretty easy. I've done workshops, and one of the things I tell people is how to get started. If you have some material and you present an example . . . just stop there and let them do the second example. . . . And then after you start doing that for a little bit, you start getting some insight into some other kinds of things that you can do.

**Ledlow:** If you're not using a pre-designed activity like Think-Pair-Share, how would you go about planning an activity? How do you structure it?

**Pimmel:** It depends on what we're talking about. If we're talking about some informal exercise in class, there wouldn't be much structure to it. I would just say, "Get together with two or three other people and work this out; and when you're done, I'll pick three teams, and a person on each of the teams will report out their answer." . . . . Sometimes I'll have them do that, and they'll be writing their solutions down in a classroom where I have a projection system [and] a camera, and I'll ask three people to give me their paper.

In the capstone course, where they have formal teams . . . I'll randomly pick teams to report out, and I'll ask them questions like, "Who was the last person in [the team] that was in a swimming pool?" And that's the person who's going to report.

When they do their [out-of-class] project . . . I tell them they ought to have roles, and they can set them up for the whole duration of the project—one person being the leader, one person being the recorder, whatever they want. Or they can rotate it every two weeks or however they want to do it, but they ought to decide that. I don't get in the way of that. I let them do it.

**Ledlow:** A common question from faculty who aren't familiar with cooperative learning is, "What are you doing while your students are working together in teams?"

**Pimmel:** A lot of times, I'll just go around and help individual teams that are having trouble with something. I'll go around and watch them work. And if you're walking around and everybody's busy solving the problem and moving ahead with it, you know they're keeping up with it. If everybody's sitting scratching their head, stumbling around, you know that you've lost them. So that's one of the things I do—use it as assessment time to go around and find out what's going on.

**Ledlow:** Do you intervene? If everybody's stuck, do you stop the class and regroup? Or if one team is stuck, do you intervene with them individually?

**Pimmel:** As I'm going around, [if] one group is stuck, I'll try to give them clues. If I go around and every place I stop and talk nobody knows what's going on, then I'll stop the activity and go back and go through that one and give them another one. It doesn't make any sense for them to sit there and not accomplish anything, if that's the case with everybody. I sort of aim for somewhere around half or so being able to go through the process.

**Ledlow:** When the teams are done with the problem or time's up, how do you debrief?

**Pimmel:** Again, numerous ways. In the larger class where it's all informal, what I'll do is ask a few students—if it's something they can just say, a sentence or something, I'll ask them to just say it, a number or something. I have the ELMO projection system, so if it's eight or ten lines on a piece of paper, I'll pick up three or four papers, I'll show them and

ask if this solution is right. . . . Then, if there's confusion at that point, I'll probably work the problem myself. If there's not, I'll go ahead.

One of the things that's kind of fun to do is if the answer's a number, I can go through the whole class. If there [are] seven teams, each of them will give me a number. . . . I'll write them on the board, and then we vote. If the right answer has the majority, then I say that's right by consensus. They have fun with that, and, if they get the wrong answer, then I sort of hem and haw and say, "I'm going to have to vote on this one."

**Ledlow:** Do you have any special tips for managing teams effectively? For example, do you use team folders or any sort of classroom management software like Blackboard or WebCT?

**Pimmel:** On teams that have an extended life and are working on a particular project, I believe in periodic evaluations. In the computer architecture class, they have two four-week projects, and they have goals at the end of each week—they're supposed to be to "this point." So I have little weekly progress reports with three questions: our team worked hard this week?—"no," "almost," or "yes"; our team accomplished our goal this week?—"no," "almost," or "yes"; and the last one . . . our team is functioning effectively?—"no," "almost," or "yes." Then I ask them to identify any hitchhikers, and then I have a comment section . . . If there are problems, I call them up and talk to them briefly. Usually they've solved the problem when I talk to them. Once they sat down and thought a minute, they realized there was a problem, and they took care of it.

**Ledlow:** One final question on classroom management: is managing your class different in terms of handling the papers, the grading, and the materials? Are the nuts and bolts of managing your daily class different now that you use cooperative learning?

**Pimmel:** Again, it all varies on what exactly I'm doing. For example, in the senior architecture class . . . when they stop to do one of these exercises, I have them, as a team, write one answer out—one piece of paper with one answer on it. Then we'll go on, and they'll have two, three, four a period—and I collect those papers and grade them: ten points for right, eight points for not right, and everybody that's there gets that credit. So it's one paper per team, so it's no big deal grading it, but it's all the difference in the world in terms of their involvement in the process. I had a hard time getting them to participate and keep their interest up, but that has really helped a lot. . . . When you're doing a capstone course where you're turning them loose a lot more of the time, it totally changes what you do. You've got to come in with transparencies, a random number generator, and pens for them to write with. I never worried about that stuff before.

**Ledlow:** Moving into a little on grading, assessing, and reflecting now—in your different classes, what would you say is your ratio of group grades to individual grades, and how does that vary?

**Pimmel:** Most of it is still individual grades. Again, it varies. Start with the junior-level digital systems course: there's no group grade at all in there. They're encouraged to do their homework in teams they form on their own, ad hoc. If they do it, they turn in one paper with everybody's name on it, so they all get the same grade. I guess that's sort of group grading, but I don't worry about that—it's up to them.

In the senior course, with the in-class exercises, they all get the same grade, because it's all one paper. In the projects they turn in reports—one report for the group—and they get a group grade for the report; and—this is going to get complicated—then I give a quiz, and they have an individual grade for that. Then I have them do peer evaluations, where they give each other an effort score up to one hundred percent. . . . I get an effort score [for each individual] by averaging. So, from that and the group score, I can get an individual report grade. . . . In that course it's about half group grade, half individual. The capstone course is probably about ninety percent group grade, and ten to twenty percent individual grade.

**Ledlow:** It sounds like, from what you were saying, though, that you don't grade a lot of the in-class, informal problem solving?

**Pimmel:** Not a lot except in the one course, the senior computer architecture class, but it's sort of superficial grading. And I don't grade team effort. I let them do that.

**Ledlow:** How do you get feedback on whether or not a lesson that you've designed and implemented is successful? Is it from students, from other colleagues, some combination?

**Pimmel:** Mostly students. If they're doing something, I can walk around and see whether or not they're able to do it. In one class I have seventeen [teams], so I can survey everybody and see if they got the right answer, so I get a good feeling there. I do the classroom assessment—the paper stuff—at irregular intervals. The tests are another way of finding out exactly what's going on. When I collect those papers from these in-class exercises, if nobody got it right, then I know they didn't quite get it. Sometimes I don't really expect them to get it—in asking a question to set them up to take them into a new idea—but other times you really would hope they would all get it right.

**Ledlow:** You've mentioned a little bit about out-of-class projects. How often do you expect that students will be working together outside of class on group projects?

**Pimmel:** It depends. Some of them set it up—and I try to discourage this—so that whenever they do any work, they're together, and I think they're not going to get very much done. They need to work individually, too. I would expect that twice a week would be probably enough time. In most of these courses, they're meeting three times during the week anyway, or two times during the week depending on the schedule, so they're in that contact; but then outside class I would expect a couple of meetings a week.

**Ledlow:** It's hard to manage out-of-class teamwork—you don't get that immediate feedback that you do in class. So when having students work on a project out of class, what do you do not to get those complaints that one student did all the work, or one student dominated, or that sort of thing?

**Pimmel:** I use [out-of-class assignments] in two courses—one again is the senior computer architecture course. I have those weekly progress reports that I talked about, where they tell me, did they accomplish the goals, did they work enough, is their team operating, and do they have any particular personnel problem. So it's a weekly contact for me.

In the capstone course, we have it set up where there's an instructor for the course, and then there are supervisors for the different projects and the different areas. So this semester I'm teaching the course, but I also have three of the design teams—there are five [other teams] that other people are supervising. In my teams, I meet weekly, and so I know what's going on. . . . For the course they have three activities, sort of milestones—their proposal presentation, the design presentation, and the final presentation at the end. But after the first two, I give them a participation survey that asks what percentage of the work are each of your teammates doing. I'll look at that and if it's pretty close—if one's twenty-seven and the other's twenty-two—I don't think that matters. But if one's thirty-five and somebody else's is twenty or fifteen, then it makes a difference. So I pass them on to the project supervisor and suggest that they do something. If it's my team, then I'll call them in and talk to them. In the last two to three years, I had one team that had problems—it really wasn't a problem, just the beginning of a problem. I told the individual, "There's no problem yet, but it's starting; it can get out of hand, and you're going to suffer from it." And he said he'd take care of it, and he did.

**Ledlow:** So you haven't had a lot of experience with people coming to you and saying, "I hate my team. Give me another team; we're in trouble?"

**Pimmel:** Students are used to being on teams now. They expect it, and if they have bad teams, and they know that's the case, they know they have to get through it. If they have a particular problem, they do come to me. Another example: a couple of years ago I had a team where there was a really bright student . . . and he would do things he was interested in, and the other stuff, he wouldn't fool around with. Well, he was really interested in this computer stuff—he was a computer nerd—and so he got the problem, and he took off, and, in the first week he tried to do the problem himself—and it's a four-week problem. So he left his team behind, and they told me about it. I called him in and told him, "You're part of a team and you've got to learn to do this . . . if you get it all done [by yourself], it's not going to help anything, because they're not going to understand what's going on, and you're going to suffer for that." So he backed off, and that team turned out pretty well. At the end, they all gave each other pretty even ratings.

**Ledlow:** How large are your classes?

**Pimmel:** The auditorium class can be fifty, sixty, up to one hundred. The senior architecture course is thirty to sixty. The capstone course is usually around twenty-five to thirty-five.

**Ledlow:** Are your cooperative learning strategies different in your smaller courses than in your larger courses?

**Pimmel:** Yes. With a hundred students, collecting those papers and grading those papers would be a significant amount of time each day. Whereas in this other class I have seventeen [teams], so I can do it in ten minutes. It's no burden. But if I had a hundred, that would be twenty-five—time for grading is not linear with the number of people—so I probably wouldn't do it in there. I wouldn't grade them every time. I might grade them occasionally—collect them every time, but grade them occasionally. I've done that.

**Ledlow:** Are there some strategies that you wouldn't do in a large class or some stuff that seems to work well in a large class that you think just isn't right in a small class?

**Pimmel:** You can give a smaller class more obtuse, complicated problems because you can go around and help them a little bit. With a big class, if things aren't going right, you have to stop the whole thing and start over. So that's a big difference. And maybe it's the level of the students, too, because the bigger class is a lower-level class, so those students are not quite as mature intellectually and experienced. You have to do simpler things. They don't like it if they have questions they can't answer; they get frustrated by that. But in the senior class, I can do that a little more.

**Ledlow:** As you've gotten more skilled as a cooperative learning teacher, what's changed? How have you evolved?

**Pimmel:** I think probably my exams are pretty much the same. I don't think that's changed. I've always written objectives and I still do that. That hasn't changed. The pace is probably a little bit slower. I can talk faster than they can think, so if I'm lecturing for fifty minutes, I can cover more material than I can when I talk for thirty minutes and let them think for twenty minutes. . . .

You become a lot more sensitive to what they're actually learning. By interacting with them and allowing them to do some things in class, you really find out where they're at. And I think that has forced me to even slow down a little more, take more material out of the course. Because you used to be able to just go ahead and not worry about that, but all of a sudden now you get immediate feedback that they're not quite understanding what you were talking about. You may not do it that semester, but lots of times I'll change, the next semester I teach the course. So it's feedback, but it's slow feedback.

**Ledlow:** If another engineering faculty member came to you and said “I’ve never done this cooperative learning stuff before. What advice do you have for me?” what would you tell that person?

**Pimmel:** I’d tell them it’s a pretty interesting thing. I’d point out, first of all, the idea. . . . If you’re talking for fifty minutes, at the end of the fifty minutes, you’re not talking to anybody but yourself. By breaking up [the material] in shorter pieces, you keep their attention. By getting them involved in doing things, they get the immediate satisfaction of making sure they understand it. And after finding out they understand it, it gets them involved, and so they’re ready to come back and pay attention for a little longer. I think those are really important ideas.

I don’t think it’s all that hard to do. I think there are fairly easy things you can do. For example, as we said before, if you’re going to talk about something and do two examples, you do one and let them do the other. And every faculty member I know asks rhetorical questions; those are easy to turn into cooperative learning exercises, and they work very well.

One of the ones I use a lot is where you want to teach something by analogy. In the computer course, we teach how to do multiplication, and multiplication involves repeated adds and shifting of numbers. We go through it and build up all kinds of algorithms. Then we go into divisions. And I say, “Okay now, if you do ‘add’ in multiplication, what are you going to do in division—‘subtract.’” That kind of stuff works really well—where you ask those questions and let their group spend a minute on it and see if they can come up with an answer. . . .

I think if you’re going to do extended projects [with] groups, then it’s almost immoral for a faculty member not to have some sort of formal structure to it, some training, some sort of monitoring of the progress, and some sort of peer evaluation at the end. I don’t see how you ever run projects without it—and I used to do it! And I’ve found the results are so much better; the design projects are so much better; the effort is so much more satisfying for the students. You don’t get all that complaining about, “I’m doing all the work, and they’re doing nothing,” or, “He’s not cooperating and we can never meet.” All that stuff goes away, and you do get a good experience with it.

**Ledlow:** Could you share some of your best experiences with cooperative learning? Why are you a convert?

**Pimmel:** I think, first of all, it really does improve the learning. Like I said, I think for certain ideas, there’s no other way to teach it. Like . . . teaching communication skills. If you talk to somebody for fifty minutes about communication skills—particularly engineering students—after you talk for about three minutes, they’ll say, “This is obvious.” . . . . When you lay down the five or eight guidelines for a good oral presentation, they’re all “obvious.” But if you force them to develop [guidelines] on their own and evolve into that knowledge, then it’s not so obvious, because they thought of it and created it. So I think that’s been a real good experience. . . . They really do get a

hold of those ideas and internalize and make them part of their own professional development.

As I was saying earlier, when I was teaching two courses and I made one of them a cooperative learning course and the other [I] was teaching the traditional way—I had PowerPoint slides and all that glitzy stuff [in the traditional course], but I got bored. So the next semester that course becomes cooperative.

The experience with teams in extended projects has really been good. The first time I did that, I had lots of complaints from students about their teams; their projects just never worked, and half the students ended up with designs only partially done. Once I started moving more and more into the teaming—monitoring and reporting aspects of it—they all started finishing the projects. So it was a real positive experience, too. I got a lot better work out of groups and extended projects by using cooperative methods and training and monitoring.

**Ledlow:** Do you have a favorite lesson or activity that you do with your students?

**Pimmel:** The extended project where they design a controller for a computer system—I give them the computer system and they have to design the controller. When that's all said and done, they feel like they've really accomplished something. That it was a hard problem and, when they started, they didn't know how to do it, [made them] feel like they accomplished something of significance. . . . They also felt very good about the teaming experience, which is satisfying. It's a pleasure to watch these kids develop their presentation skills, design skills, and group skills; and I don't think that was happening before.

**Ledlow:** Thank you.

**Pimmel:** You're welcome.