

# First ARRL Education and Technology Program Teachers Institute Revs Up Educators



A group of nine enthusiastic educators from across the US comprised the inaugural class of the ARRL Education and Technology Program (ETP) Teachers Institute August 6-13 at ARRL Headquarters. Depending on continued donations, the seminar will become an annual event. Its aim is to acquaint participants with effective approaches to teach wireless technology and electronics. After-class comments and suggestions from attendees—most of whom are associated with ETP schools—indicated they wished the Teachers Institute could have been longer.

“We would like to see an additional two days and maybe some evening seminars too,” were among recommendations attendees expressed. Those definitely are *not* the kinds of sentiments you’d expect to hear from students going to “summer school.”

The Teachers Institute freshman class included teacher-hams, non-teacher hams, non-ham teachers and community volunteers from high, middle and elementary school programs. One ARRL staff member, Debra Johnson, KB1LMT, audited the sessions. ARRL Education and Technology Program Coordinator Mark Spencer, WA8SME, served as the institute’s lead instructor.

“I could not have asked for a better demographic mix of participants than those who attended,” he said. Spencer says the inspiration for the Teachers Institute grew out of an observation that many teachers hesitate to include wireless technology instruction in their classrooms.

“Teachers teach the way they were taught, and teachers teach what they are most familiar with,” he explained. “Even though they may be experienced ham radio operators, sometimes they don’t feel comfortable enough to *teach* wireless technology.”

Funded primarily through donations, the ETP (also known as “The Big Project”) provides a turnkey amateur station to participating schools and promotes Amateur Radio as a pathway to understanding radio and electronics as well as other subjects such as language arts and geography. But the program’s overarching focus is to incorporate wireless technology into today’s classrooms. Amateur Radio offers an exciting means to demonstrate and illustrate that topic. While wireless technology is present in virtually every aspect of our lives, we, as a society, by and large are ignorant of how it works. The ETP’s mission is to address that issue by raising wireless technology literacy.

“So far we have done a very good job of providing an Amateur Radio station to schools and teachers plus resources in the form of grants of equipment and activity board kits and free curriculum materials,” Spencer said. “However, the initial focus of the program was predicated on an assumption that participating teachers were prepared to teach the subject, and that’s not always the case.” The Teachers Institute has been a big step toward that goal.

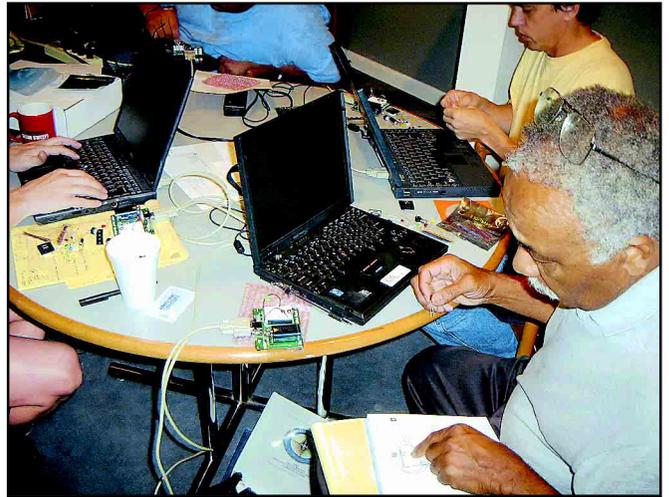
## Teaching Teachers Technology

This year’s pilot Teachers Institute included three days of instruction on how to teach wireless technology, one day on how to teach microcontroller basics and one day on how to teach basic robotics. Class materials were a mixture of a refresher in basic theory coupled with pedagogical strategies participants could use in their classrooms.

Each teacher received a resource library of ARRL materials for their classrooms, TV remote decoder and activity board kits, an OptaScope digital oscilloscope, a “What is a MicroController” instructional kit and a “BOE-BOT Robotics” instructional kit. Participants also got a chance to preview future ETP kit offerings—including the L/C/Resonance and DSP Fundamentals



From the left: Don Wilson, K1IN, and Brian Brethauer, KC8NPH, work their way through an activity board project.



At the round table: Wilson joins other class participants in wiring up a microcontroller experiment. To his right is Mike Pagoria.

board and the receiver kit. All told, they took home a package worth approximately \$2000, but priceless in terms of reaching their students.

### Better than Harvard?

While offering some suggestions for future institutes, the educators who attended the premier session by and large judged it a positive experience. One even said it was the best seminar he'd ever attended, "Harvard included."

Others said they enjoyed the many hands-on activities throughout the week. Spencer is a big proponent of learning by doing.

"The use of the computer oscilloscope software is outstanding," another participant said. "The ability to build a sound



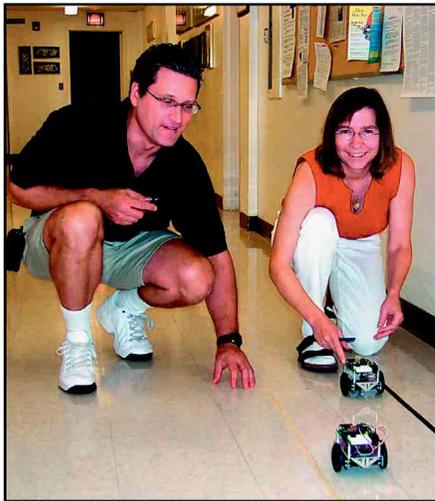
ARRL ETP Coordinator and Teachers Institute Lead Instructor Mark Spencer, WA8SME (right), guides Ronny Risinger, KC5EES, through a robot chip programming exercise.



Spencer (left), explains a live satellite transmission as part of the seminar's "Space in the Classroom at Little or No Cost" unit, while Ronny Risinger, KC5EES, and Don Wilson, K1IN, look on.



Frank Giannini, KA1NIO (right), builds his BOE-BOT kit from the chassis up, while husband and wife Joe and Jill Mohr, KC7ZZX and KC7ZZY, team up on their robotics projects.



**The race is on!** Carl Dombrowik, N1PXL, and Jill Mohr, KC7ZZY, set their BOE-BOT programmable robot vehicles loose on the obstacle course test set up in the ARRL Headquarters hallway. "Those robots rock!" one ARRL staffer remarked.

tone generator and RC stuff with the microcontroller board and then show it on the oscilloscope is *great!*"

Others said the Institute provided an excellent foundation and opened up a world of exciting projects. "I learned a lot," another attendee summed up. "It was fun and educational. I need to now use this data and information in my classroom."

"This past week has been hard work, but at the same time rewarding work," said Spencer as the first Teachers Institute drew to a close. For their part, participants went home full of enthusiasm, re-energized and ready to get to the real work—applying what they had learned at the ARRL Teachers Institute in their *own* classrooms.

"I look forward to a better Institute next year," Spencer added. "For the participants, their own hard work has just now begun!" Spencer said plans already are in the works for next year's Teachers Institute. Drawing upon lessons learned this year—and pend-

ing sufficient funding—the strategy calls for holding two Institutes in 2005, one in late June and the second in late July. A call for applications to attend the Institutes will go out in March.

### A Word for the Sponsors

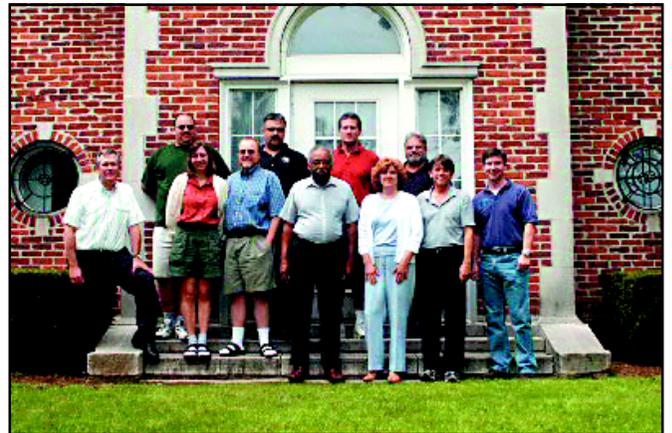
Substantial funding for the pilot Teachers Institute came from a generous member in the ARRL West Gulf Division as well as through the donations of others. The League is appealing for donations to support the Teachers Institute as an ongoing ETP activity. Donations will also make it possible to continue making project activity boards and hands-on projects available to schools.

For more information or to become a Teachers Institute sponsor, contact Mark Spencer, WA8SME, at 860-594-0396; [mspencer@arrrl.org](mailto:m Spencer@arrrl.org).

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### The Inaugural Class of the 2004 Teachers Institute

Brian Brethauer, KC8NPH, Allendale (Michigan) High School  
 Carl Dombrowik, N1PXL, A. I. Prince Tech Regional Vocational School, Hartford, Connecticut  
 Jim Foutz, AA4JF, Northside High School, Warner Robins, Georgia  
 Frank Giannini, KA1NIO, Hartford, Connecticut, Public Schools  
 Debra Johnson, KB1LMT, ARRL Headquarters  
 Jill Mohr, KC7ZZY, The Linkup Program, Oregon City, Oregon, School District  
 Joe Mohr, KC7ZZX, The Linkup Program, Oregon City, Oregon, School District  
 Mike Pagoria, St Joseph Catholic School, Palm Bay, Florida  
 Ronny Risinger, KC5EES, LBJ High School, Austin, Texas  
 Don Wilson, K1IN, community volunteer, Talcott Mountain Science Center, Avon, Connecticut



The inaugural Teachers Institute class poses with lead instructor Mark Spencer, WA8SME (left), in front of W1AW.

### New L/C/R Activity Board Opens Door to a Myriad of Teaching Possibilities

The ETP offered a new activity board to schools this fall. The "L/C/R" activity board allows students to explore capacitive and inductive reactance, verify reactance formulas using actual data taken from the activity board, measure the resonant frequency of either series or parallel L/C circuits and then put it all together to explore the relationship between capacitive and inductive reactance and resonance.

Because the board uses a microcontroller and a digital-to-analog converter (DAC) to generate the ac waveform used to explore L/C circuits, there is an additional learning opportunity: digital signal processing (DSP) fundamentals. This facet of the board leads to exploration of root mean square (rms) voltage and current and the mathematical derivation of rms.

"In other words, there is a whole lot of activity packed into this little board," said ARRL ETP Coordinator Mark Spencer, WA8SME. Given the level of mathematics required, he said, the activity board is intended for high school physics or second-year algebra students. But Spencer says anyone studying for the General or Amateur Extra examination could also benefit from the learning opportunities the activity board affords.

Students use mathematical, graphing, graphing calculator, spreadsheet and critical-thinking skills to demystify the data collected during the various board activities. For example,

students use graphing calculator curve-fitting techniques to verify reactance formulas. Spreadsheet software helps them to make sense out of the raw voltage and current data measurements. During the DSP activities, students use the OptaScope to see the stair-step waveform generated by the computer and the DAC on one channel, and the smoothed waveform exiting a simple filter on the other.

"Visualizing a waveform in discrete slices helps students understand what happens during DSP," Spencer explains. "Then, students explore the mathematical concepts that are the foundation of root mean square by using the amplitude of each slice to computer-average and rms voltages. This really helps to clarify these important ac concepts."

Another new activity board kit available in January 2005 is a simple and inexpensive direct-conversion receiver kit, produced by the American QRP Club, which includes a two-level instructional curriculum. The first level describes the operation and function of each major receiver circuit, from antenna to headphones. The second describes the function of individual components within a circuit block.

For more information about these boards and the Education and Technology Program, contact Mark Spencer at 860-594-0396; [mspencer@arrrl.org](mailto:m Spencer@arrrl.org).

