Ham Radio 101 at Granite Bay Montessori School

Ham radio helps grade school students understand our wireless world.

Brian Lloyd, WB6RQN/J79BPL

TERI BROWN

Figure 1 — From a BoeBot robot to a crystal set and onward to an Elecraft K2 transceiver, the Wireless Technology Class is proud of their accomplishments.

One of the things that has changed in science over the last 20 years or so is a shift toward physics as the basis of all science. Even biology and chemistry have shifted over to a physics-centric view of the world where quantum processes dominate.

Regardless, physics and physical science still seems to take a back seat in elementary education. When I got the opportunity to teach a hands-on science program to 4th through 8th grade students at Granite Bay (California) Montessori School I decided I would stress the teaching of physics and physical science (see Figure 1). With that goal in mind what better way to illustrate the principles of electricity, magnetism and light than Amateur Radio!

Hands-on Science the Montessori Way

The first year I focused on mechanics and mechanical processes. We studied Newton's three laws and built simple machines such as catapults, trebuchets and rockets. The new program was a hit with both students and parents.

The second year I was planning to teach about electricity, magnetism and light. That is when I considered making Amateur Radio a part of the curriculum.

As a long-time member of the ARRL, I was aware of the program to introduce Amateur Radio into the classroom. I contacted the ARRL and connected with Mark Spencer, WA8SME, the Program Coordinator for the ARRL Education & Technology Program (ETP). Mark suggested that I submit a grant proposal to fund a station for the school. He also suggested that I apply to attend the ARRL Teachers Institute on Wireless Technology.

The Teachers Institute was a fantastic weeklong program. I am an electrical engineer, a computer scientist and an Extra class ham, but it was ARRL's Teachers Institute that brought everything into focus. As a result of what I brought back, I added two

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Figure 2 — Students assemble the school's GAP Titan DX antenna provided by ARRL donors through the Education & Technology Fund. From the left: Joshua Fournier, KI6PJW; Quintin Winbush, KI6QYT; Blair Mitchell, KI6PJX; Josée Fournier, KI6QLP; Tina Zolfaghari, KI6QLT; Teri Nittler, KI6QLQ; Brian Lloyd, WB6RQN, and Cameron Lloyd, KJ6BQC.

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BRIAN LLOYD, WB6RQN

Figure 3 — Rachel Finerman, KI6PJY (left) and Christina Soltero, KI6QLR, solder a circuit for the Elecraft K2 provided by ARRL donors through the Education & Technology Fund. The students would work in teams of two with one student doing the work and the other checking the work. That kept our errors to a minimum.

BRIAN LLOYD, WB6RQN

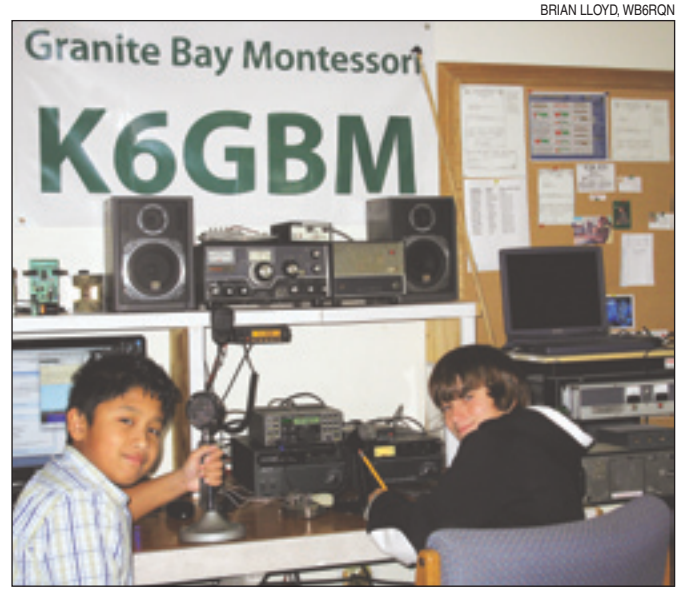

Figure 4 — Kristian Gagni, KI6ZGS (left) and Jacob Smith are two new students getting on the air at K6GBM.

classes for the 5th through 8th graders: robotics and wireless technology.

Robotics combines the electricity and the mechanical concepts we learned the previous year. It also introduces the concept of programming, that is, breaking down a problem into small, discrete steps.

Wireless technology was intended to help students understand the workings of the myriad wireless devices encountered every day. It also allowed me to provide another application for the basic understanding of electricity and electronics in a hands-on way.

Making It Work

The first thing I did after the Teachers Institute was bring some of the ideas back to the classroom in summer school. I introduced some of the students to the robots to see how they would take to them. The students were wildly enthusiastic and showed much more capability than I thought possible.

Shortly thereafter our grant for an HF station from the ARRL was approved. I requested an Elecraft K2 transceiver kit with the idea that the students would gain experience and confidence from constructing a complex HF transceiver.

We started by building a work area in our classroom. This involved building a work surface with carrels for computer, robotics and construction activities. The students and I constructed a new computer network for the computers donated by Phil Karn, KA9Q. We set aside a portion to be our station location and poured a concrete base for a 25 foot tower that would hold the GAP Titan DX 80-10 meter antenna.

In the fall the equipment started coming in. The students assembled the antenna and we had an antenna-raising party (see Figure 2). I loaned the school my ICOM IC-706MKII so we could get on the air right away. We set up a work area to assemble the K2 (see Figure 3). Students worked in pairs so that there was always someone cross-checking. It took almost 6 months to complete the K2, but the transceiver worked perfectly the first time we fired it up. When we completed the main RF board it was passed around to exclamations of, "Hey, I did that part!"

Each student constructed a classic crystal radio right down to winding the coil. Get the project details on the ARRL Web site.[1] Some students decided they liked working on "boat anchors" so now we have a working Swan 250C 6 meter transceiver (see Figure 4) and a Gonset G-63 HF receiver. Whenever I ask, "What do you want to work on today?" I can always count on answers of, "Let's build something," and, "Solder!" Olivia Brophy, KI6TWK, a 6th grade student, shares her thoughts about our classroom adventure with ham radio. You'll find her comments on the ARRL Web site.[2]

The school administration decided that the idea of every 5th through 8th year student getting their Technician class license was a good thing. I interleaved the discussion of basic scientific principles with the specifics needed to pass the Technician test. Having a specific application for the scientific concepts made the whole process of learning science more relevant to the students.

Interfacing with the Ham Community

One of the requirements for the ETP grant was to get a local ham club involved to support the project. To meet the requirement I approached the River City Amateur Radio Communication Society (RCARCS) (**www.n6na.org/HomePage**). They agreed to support us, provide a library of Amateur Radio related reference material and run Volunteer Examiner sessions for the kids at the school. This turned out to be a great working relationship and we can't thank the hams of RCARCS enough.

Other hams came out of the woodwork as well. I would take the students to hamfests where we would solicit donations of equipment. It isn't enough just to get them their tickets. They have to be able to operate on a regular basis. Donations have made this possible. To that end we now have an extra HF rig and several 2 meter and 70 centimeter rigs that students can take home to operate.

One ham, Dale Kretzer, K6PJV, now comes to the school each week to teach students CW. A couple now operate CW as a result. He is also available to advise students on building antennas and setting up their own stations.

Unfortunately, not all interactions with the ham community have been positive. Early on, when teaching about repeater operations I let the students establish contacts using various repeaters. Most of these contacts were positive but one repeater group was very negative.

That experience demonstrated that 10-year-old girls and 70-year-old men don't have a lot in common to ragchew about. I realized we were going to need a place where young operators could go to talk about the things that interested them.

To that end I decided to install a repeater

[1]Notes appear on page 69.

at the school that would allow students to ragchew with each other. In addition I decided to connect it to EchoLink so that students from other schools could contact students at our school. Al Koepke, K1JCL, donated a 70 cm repeater and duplexer to the school. We now have that set up in the classroom and the students regularly use it to contact each other. As soon as a student gets their ticket they are handed a handheld transceiver and get to make a call on the repeater knowing that a friend will answer. That makes that first contact less threatening and more fun.

Assessment and the Future

The program is working. I have a new crop of 5th graders this year working through *The ARRL Ham Radio License Manual*. All 16 students who started in the program 2 years ago have earned a Technician class license and two have upgraded to General. This past school year four more earned their licenses, including one 5th grade girl who has already upgraded to General.

Three science fair projects this past school year were ham radio related and placed high in both the engineering and the math and computer science categories at the Sacramento Regional Science Fair.[3]

We have received another grant from the ARRL to add a 130 W photovoltaic solar panel to our station, which provides 100 percent of the power to run our HF transceiver, our 2 meter transceiver and our 70 cm repeater.

We now have two Field Days under our belts as well. In 2008 the kids were just learning so they assisted as the adults did much of the set up. For 2009 the kids were formed into teams, each team responsible for one aspect of Field Day. Other than one HF radio that failed early on, we ran 2A without a hitch with the kids doing all the set up, operating, cooking and clean-up.

So, as I said, the program is working. Students are starting to dream up their own projects and getting their own stations on the air. Ham radio is quickly becoming a regular part of their lives. It gives me hope that there will indeed be another generation to keep our hobby alive.

If you are interested in our program or wish to contribute, please contact me or any of our students. Our repeater is K6GBM on 444.35 MHz(+), CTCSS 114.8 Hz, also via EchoLink at K6GBM-R (node 399102). We are always looking for new contacts. See you on the air.

Notes

[1]Get the project details in the Lloyd Crystal Radio document at **www.arrl.org/files/qst-binaries**.

[2]Olivia's comments can be found in the Lloyd Brophy document at **www.arrl.org/files/qst-binaries**.

[3]Read more about the science fair winners on the ARRL Web site at **www.arrl.org/news/features/2009/04/15/10770/?nc=1**.

Brian Lloyd, WB6RQN, an ARRL member, has been a ham since 1976 and holds an Extra class license. Brian was very active in packet radio and used to write the column "Packet Talk" for 73 Amateur Radio Magazine in the late 1980s. His activity in packet radio led him to go on to develop protocols for the Internet, most notably PPP and Multi-link PPP. Brian started and ran several successful Internet technology companies until coming to Granite Bay Montessori School 4 years ago. When not on the radio or teaching class he is also an active flight instructor. He can be reached at 3191 Western Dr, Cameron Park, CA 95682-9205, **wb6rqn@arrl.net**.

New Products

DAYTON 2009 VIDEO COLLECTION

◊*The Dayton Collection 2009* from Amateur Radio Video News (ARVN) is a set of three DVDs with highlights of forums and events held throughout the Dayton Hamvention® weekend. On DVD 1, producer Gary Pearce, KN4AQ, and reporter Jeff Wittich, AC4ZO, tour the Dayton Hamvention and present a funny and informative 42 minute look at some of the more unusual aspects. This DVD also includes the 2009 FCC Forum (1 hour, 10 minutes), 2009 ARRL Forum (44 minutes) and a look back at the 2008 FCC Forum and the last talk by Riley Hollingsworth, K4ZDH (1 hour, 13 minutes). DVD 2 is more technical and features multiple presentations from the TAPR Forum (1 hour, 36 minutes) and the Software Defined Radio Forum (2 hours, 36 minutes). DVD 3 features a number of presentations from the D-STAR Friday Forum (1 hour, 22 minutes) and D-STAR Friday Night Event (1 hour, 28 minutes). The DVDs are professionally produced with quality video, audio and navigation menus. Intended for individual viewing or club meeting programs, *The Dayton Collection 2009* offers hours of informative viewing and entertainment. Detailed information on contents of each DVD and sample video are available on the ARVN Web site. Price: $15 per DVD. For more information or to order, visit **www.arvideonews.com**.

MASTER PUBLISHING GROL + RADAR STUDY MANUAL FOR COMMERCIAL RADIO LICENSE

◊New question pools for commercial radio license examination Elements 1, 3 and 8, effective December 26, 2009, cover basic radio law and operating practice, electronic fundamentals and techniques required to adjust, repair and maintain radio transmitters and shipboard radar equipment. Element 1 is the Marine Radio Operator Permit, the basic FCC commercial radio operator license. Element 3 is the General Radiotelephone Operator License, required for those who maintain marine and aviation radio equipment. Element 8 is the Radar Endorsement, for those who maintain radar systems. Written by Gordon West, WB6NOA, the new GROL + RADAR license preparation study manual from Master Publishing is a 320 page, large format, fully illustrated book that provides an explanation for every question, along with the concept behind solving for the correct answer. The manual begins with a brief history of commercial radio license regulations, and a chapter clearly spells out when a commercial radio license is required and which one should be obtained. It also includes a CD-ROM containing the complete FCC rules for Parts 2, 13, 23, 73, 80 and 87 as a reference. Price: $49.95; bundled with practice exam study software, $79.95. Available from radio electronics dealers, **www.amazon.com** or **www.w5yi.org**.