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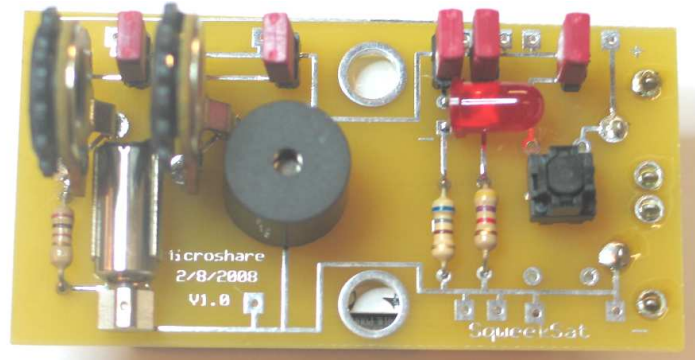
**Task 3.10**  
**Bloomington HS**  
**Workshop Review**  
by  
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**Stanford University**

May 31, 2008

**Introduction**

A four day workshop was held with students at Bloomington High School as Bloomington, CA, just east of Ontario, CA on Tuesday - Friday, May 28-30, 2008. This school has about 3000 students. The classes are about 80% Hispanic. The purpose of this workshop was to give the students some hands-on experience in building some simple electronic components. There were five classes of student - two physics classes and three chemistry classes. We started at about 8am and worked thru the regular class times until about 3pm in the afternoon with a one-half hour lunch break each day.

The first day was a lecture class on math and formulas for electronics and reading of resistor values. The second day was building a simple circuit on a proto board with a switch, resistor, LED and battery and learning the basics of soldering. The third and fourth days were used to assemble a small device shown below called a SS (SS) shown below.



The purpose for building this device is that it produces light with an LED, sound with a piezo buzzer and motion with a small vibrator motor. An instruction sheet was provided for the students to follow in the assembly.

**Summary of first two days of the workshop**

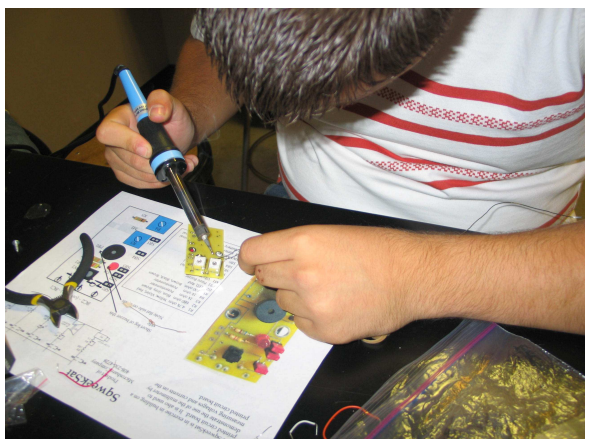
The student's attention during the first day of the workshop was from "ho-hum" to "so-what". There were a few that paid "mild" interest. They were told that there would be a five minute quiz at the beginning of class on the second day and that they could bring

one sheet of paper 8-1/5 x 11 inches with anything written on it they wanted for notes for the quiz. On the second day, when the quiz was announced at the beginning of the class, most students said they didn't know there was going to be a quiz.

About 10% actually brought some notes. I am not sure that from about 110 students, if any got two simple problems that were covered the previous day in lecture correct. I would assume only about 25% could do any work at all on the problems. These students are our future! I was really concerned.

The second day with some hands on work in the lab went much better. Most of the students were able to assemble the switch, resistor, LED and battery on a proto board and get it to work. When soldering practice came, there was less success, but more interest. No serious burns on any students. We had a lot of trouble with the soldering irons and the solder tinning the irons. It was later determined that the new lead free solder was much more difficult to use than the old solder with lead in it. We switched to lead-tin solder on the fourth day

Below is shown some of the lab setups and students.



My faith in the future got better as the students seem to get more interested as we did hands-on work.

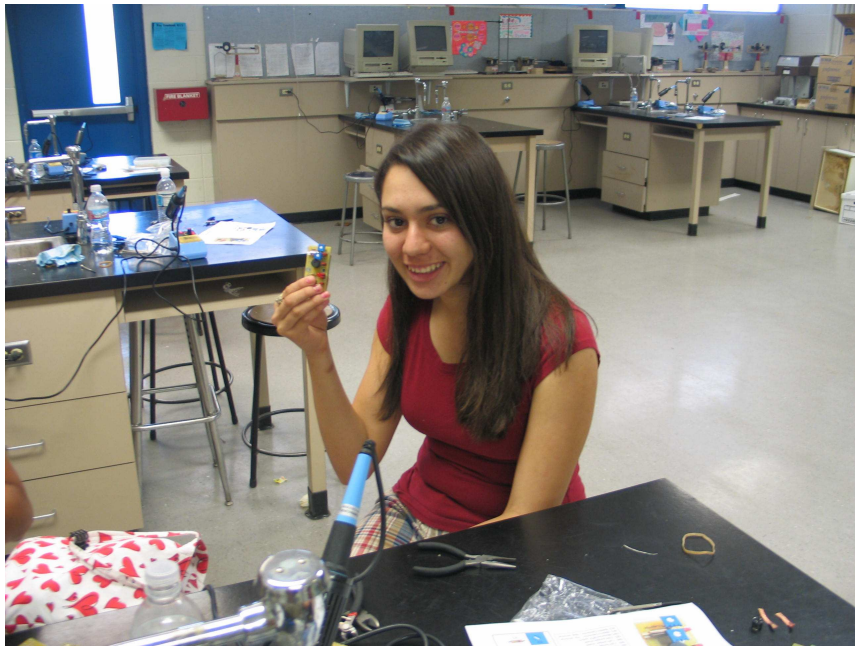
### Third Day

As we started the third day of the workshop in the assembly, their interest increased now that they were going to build something more permanent that they would keep.

Surprisingly when the students started to solder for real on their SSs, the quality of their soldering improved remarkably.

### Fourth Day

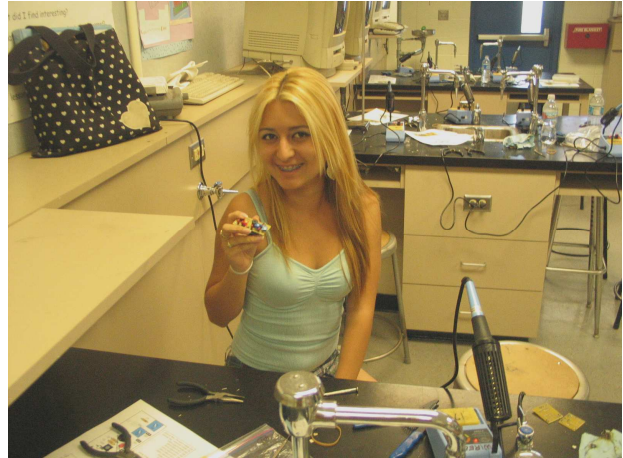
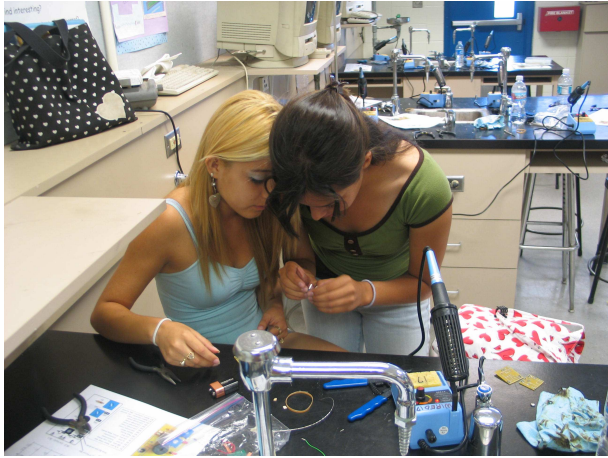
On the morning of the fourth day, students start to complete their SSs. There were some very nice smiles and excitement built among the students. One of the first completed SSs is shown below.



Since the SS make a buzzer tone with the piezo buzzer, as the students completed their devices, more and more buzzer tones were going off in the room and lots of smiley faces appeared with that satisfaction look. It was almost like building their own iPod.

Those that finished first moved on to help their friends on their devices. Students are now teaching other students – best for both as shown below.





About 50% of the students complete their SS in the morning classes. As we left for our lunch, there were students that wanted to stay in the lab and work on their SS rather than go to lunch.

Walking to lunch and back we could hear the students with their buzzers beeping on the campus as we walked.

By the end of the following two classes in the afternoon, it seemed like about 75% or more of the students had completed their SS. One of the young ladies came up afterwards and said “Mr. Bob, I think I want to be a scientist”.

**Maybe we did make a difference for some – which was our goal.**

Mr. Chris Maness, the teacher, worked very hard with the students correcting problems and promised the students they could work to finish their SS on Monday.

### Lessons learned by me.

1. Have more faith in the students.
2. Once you get to know them better, they are really a lot of fun to be around.
3. Be prepared for a lot of work when having only two people, Chris and myself to help classes with up to thirty students.
4. Prepare to get humbled by some really nice students.

## Workshop Lessons Learned

1. Make sure that you test ALL of the equipment before you get to the workshop. That includes having a way to test all the most critical parts.
2. Allow at least 10-15% replacement for mistakes by students that cause replacements or reworks – happens even with experienced assemblers.
3. Make some redesigns in the SS printed circuit board for easier assembly and better protection to minimize soldering problems.

## Conclusion and Acknowledgement

1. It was of prime importance and contributed greatly to the success of this workshop in having someone like Chris Maness. He had a significant technical background that he was an equal or better contributor to the class than me.
2. I feel that time will only tell on how much lasting effect this workshop had on those students we worked with at Bloomington HS, but I hope at least a few.
3. Thank you to the Principal and the staff at Bloomington HS that helped us do this workshop on behalf of the California Space Authority, the WIRED program and funding from the US Department of Labor.

## Future working with Bloomington HS

Chris and I plan to continue with some follow on projects for the students and hope to make some payloads that we can fly on the Stanford High Altitude Balloon program, the ARLISS and Cal State Long Beach rockets in the fall of this year.

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