

## In the News: May 19, 2004

### Exciting things are happening in our school projects!

We have come a long way from our first pilot project with three students at Ballard High School back in the spring of 2002. This year, we have over 100 students at four locations conducting classroom experiments using the Teralab (now VLX) software, generously provided through educational grants from Teranode. To give you an idea of the diversity of experiences and settings, here are a few statistics:

- Half the schools are using computers and support provided by UW/CSI, while the other half are running the system on their own computers with their own IT support.
- Over half the students have loaded and run the software on their home computers to create their own flowcharts and to prepare for class work.
- Students range from high school freshman (age 15) to college seniors.
- Schools range from those with well-funded and well-established science programs offering AP courses and genetics electives to others with only basic first- and second-year biology.

### How long does it take students to learn Teralab?

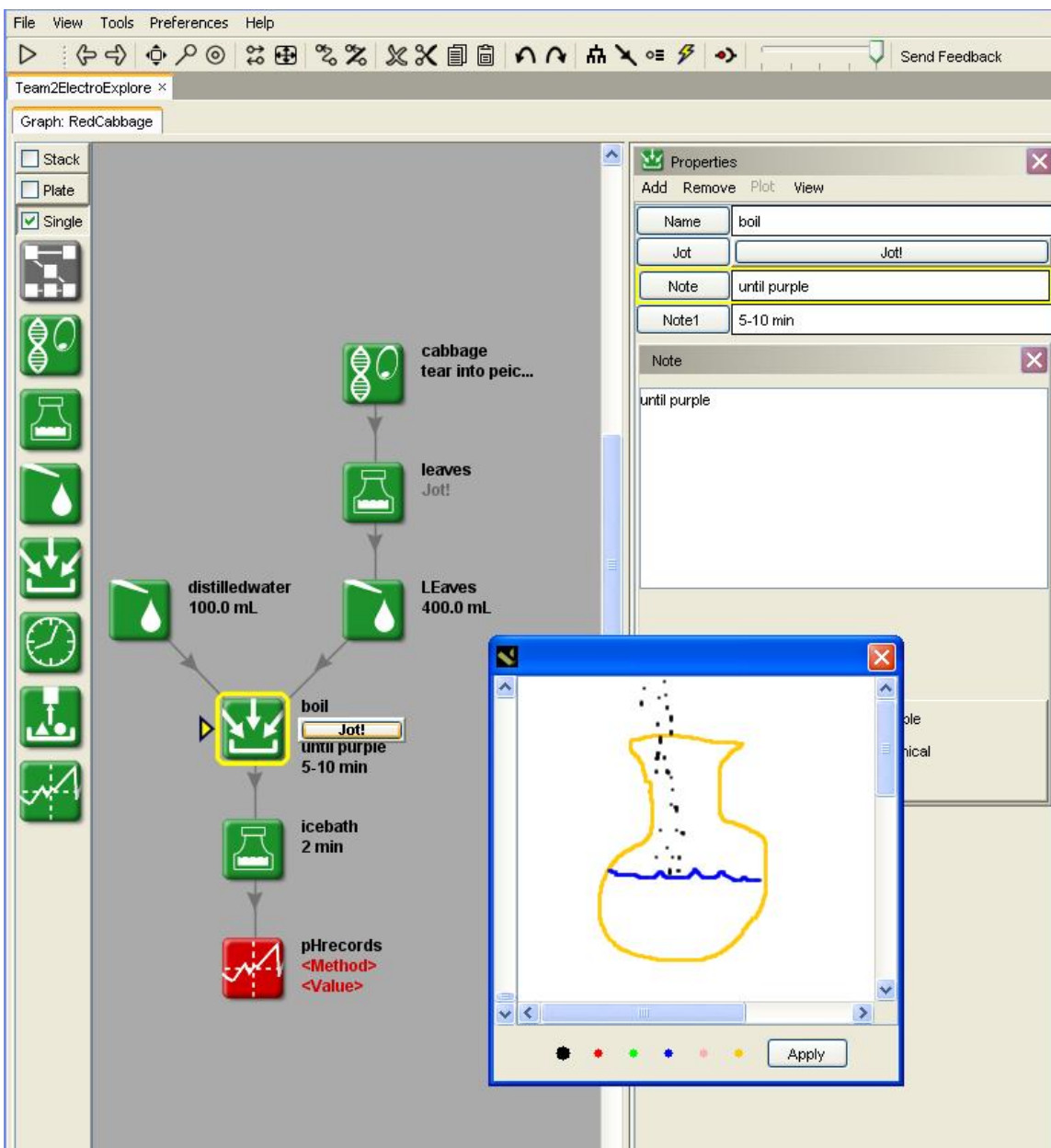
This week we saw students at a high school in Renton go from complete novices to experienced users after a single session. On Monday at 7:20 am, fifteen students filed in to their advanced biology classroom to an unusual sight (for them): half a dozen computers were set up around the classroom. For the next hour, these students got their first experience in learning to use the software and in creating their first basic flowchart. It was clear from the first ten minutes of having the students follow along that they were ready, and even impatient, to begin doing real work with the program. We were happy to comply. Five teams of students received the following short protocol to flowchart:

#### **Part A: Red Cabbage as an indicator of pH**

##### *Preparation of Red Cabbage Indicator*

1. Tear a few leaves of red cabbage into small pieces and place the leaves into a 400-mL beaker.
2. Add ~100-mL of *distilled water* to this beaker. Make sure that the leaves are completely submerged.
3. Gently boil the mixture (using the stand, ring clamp, wire gauze assembly) for 5-10 minutes until it appears dark purple in color.
4. Transfer the beaker and its contents to an ice bath for 2 minutes for rapid cooling.
5. During this cooling period observe and record the colors of the red cabbage indicator with the pH standards.

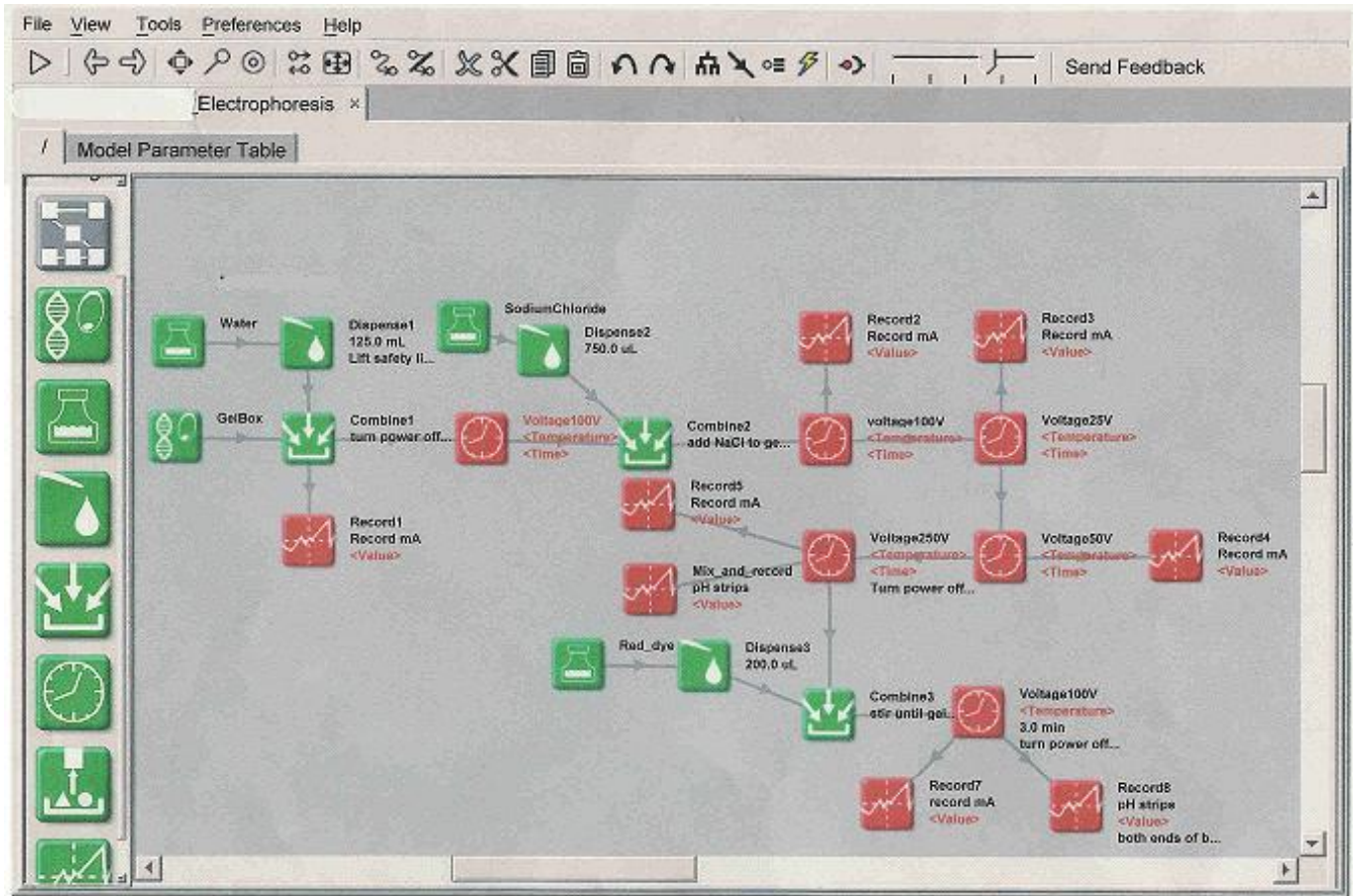
Within minutes, students were producing protocols such as this, complete with pictures to guide the experiment:



**Figure 1: Screenshot of one team's red cabbage protocol with property panel and jot open.**

That night for homework, students received a much more complicated laboratory protocol to flowchart: Electrophoresis Exploration (designed by the Fred Hutchinson Science Education Program). The majority of students were given CDs of the software to take home and install on their home computers for the assignment. Students who did not have access to computers had the option of flowcharting on paper. Knowing that the

assignment was likely to be a difficult one for a group of students who had only been introduced to the concept of a procedural flowchart for biology experiments, we were not sure what to expect. On Thursday morning at 7:20am, we found out just what they were capable of! A dozen flowcharts were handed in, only three of which were handwritten. Below is a screenshot of one student flowchart for the Electrophoresis Exploration



laboratory protocol:

Despite the clever arrangement of the icons in order to get them all on one screen, the structure is very similar to the flowchart created by an expert for the students to use in class to guide them in the experiment. Notice the detail added to the steps!

### Students doing real work with an interactive computer

Thursday students used the system in class to guide them through the laboratory protocol and to record their observations. A sample of their work is shown below with their observation notes on the right. We have now seen that students of varying backgrounds in different educational settings can learn to use the software in a single class period, begin creating their own experiment flowcharts right away, and successfully use it to do laboratory work. When they are through they have a clear overview of the process and an easily shared record of their work.

Our next challenge: to make Teralab an integral tool in biology classrooms around the country!

File View Tools Preferences Help

Team3ElectroExplore x

Graph: Electrophoresis\_Exploration.Procedure

Stack  
Plate  
Single

100 V  
9a. Lower the ...

Record3  
9b. Record the...  
Used 110 V

Change\_Current  
25 V  
10a. Select ap...  
Used 25 V  
Change\_Current2  
250 V  
10c. Move the ...

Record4  
10b. Record th...

Change\_Current3  
??  
Choose two add...

Record5  
Explanation.J...  
See Explanati...  
Used 75 V

Disconnect3  
11. Turn the p...

Record6  
Explanation.J...  
See Explanati...  
Record the res...  
No other curre...

Combine3  
13. Add 200 ul...

Step12\_Observe  
12. Lift the l...  
6.0pH (-) and ...

Connect4  
100 V  
14. Lower the ...

Step14\_Observe  
At approximate...  
[1st min] Pink...

Disconnect4  
15. Turn the p...

Step15\_Observe  
Raise the lid ...  
Pink on (-) an...

TAE\_Buffer\_50X  
2.5 ml

Combine4  
16. Gently sti...

Step16\_Observe  
Record the pH ...  
(+)side 7.4pH<br>...

Connect5  
100 V  
17. Lower the ...

Step17\_Observe  
Observe color ...  
(-) pinkish-re...

Properties

Add Remove Plot View

**Record3**  
Used 110 V

**Step12\_Observe**  
6.0pH (-) and 6.0pH (+)

**Record6**  
No other currents available

**Step14\_Observe**  
[1st min] Pink at (-) and yellow at (+), [2nd/3rd min] clear uniform yellow.  
Bubbles at the (-) end and very slight bubbles at the (+) end

**Step15\_Observe**  
Pink on (-) and yellow on (+), at the end of the test

**Step16\_Observe**  
(+)side 7.4pH  
(-)side 7.4pH

**Step 17\_Observe**  
(-) pinkish-red and (+) clear-yellow