

microLAB 2018



Define the Problem

Create Testable Idea



Test the Idea

*Plan experiment
Collect Data*

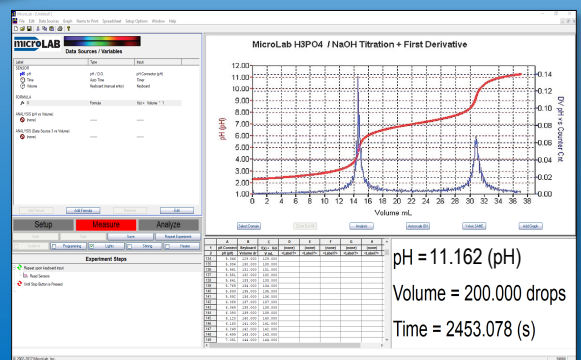
MicroLAB Experiment Builder

Evaluate Results

Is there more to it?

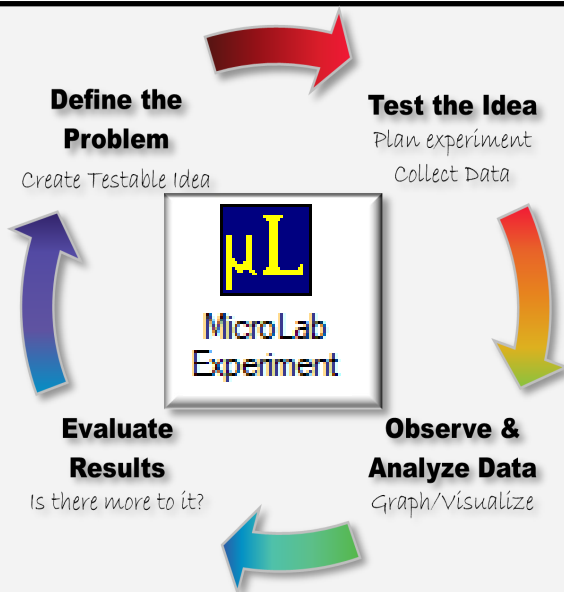
Observe & Analyze Data

Graph/Visualize

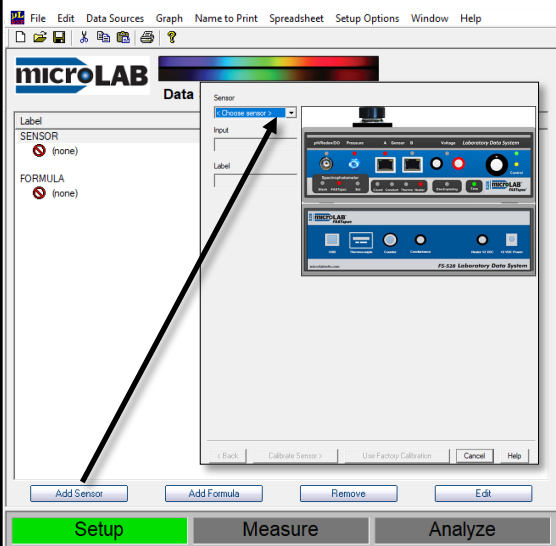


The MicroLAB Experiment Builder is a blank canvas on which learners can easily plan experiments, calibrate sensors, set up data displays, conduct experiments, and analyze data.

The drag-and-drop style experimental design tools, live data visualization tools, and analysis tools coupled with high resolution laboratory instruments encourage active engagement with chemical



Design Experiment **Measure & Visualize Data** **Data Analysis/Evaluation**

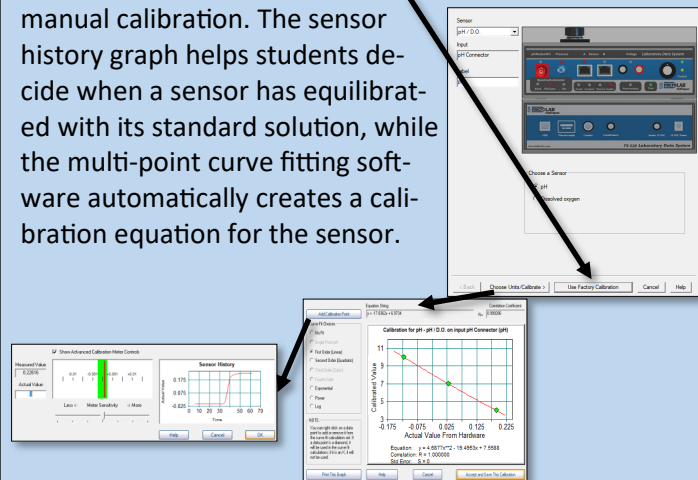


To design a MicroLAB experiment, students **Add Sensors** based on the type of data desired. The sensor selection screen directs them through the process of connecting, calibrating, and choosing settings for the selected sensor.

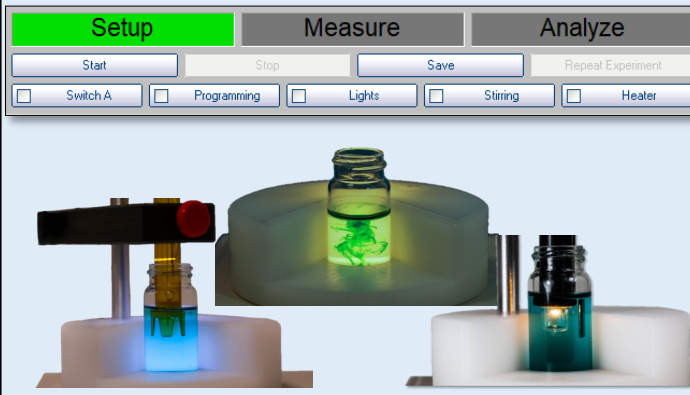
Once a sensor is added, the live digital display automatically appears with a digital reading for the sensor. Students can drag-and-drop sensors onto axes of the graph for live data visualization of the measurements, or to the data table.

In as few as 4 clicks, students can add a sensor and a timer and can be ready to start collecting data.

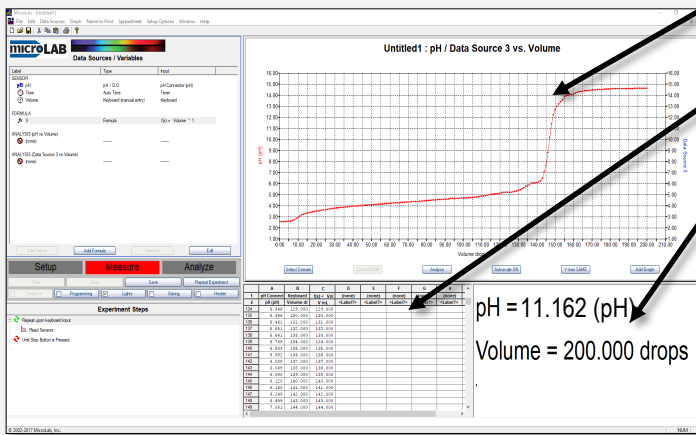
Students **Calibrate Sensors** by either using the provided *Factory Calibration* or performing a manual calibration. The sensor history graph helps students decide when a sensor has equilibrated with its standard solution, while the multi-point curve fitting software automatically creates a calibration equation for the sensor.



Students set **Experimental Conditions** such as lighting, stirring, and temperature with the sample management control section of the software display.



There are three types of **Data Visualization** available on the software display.



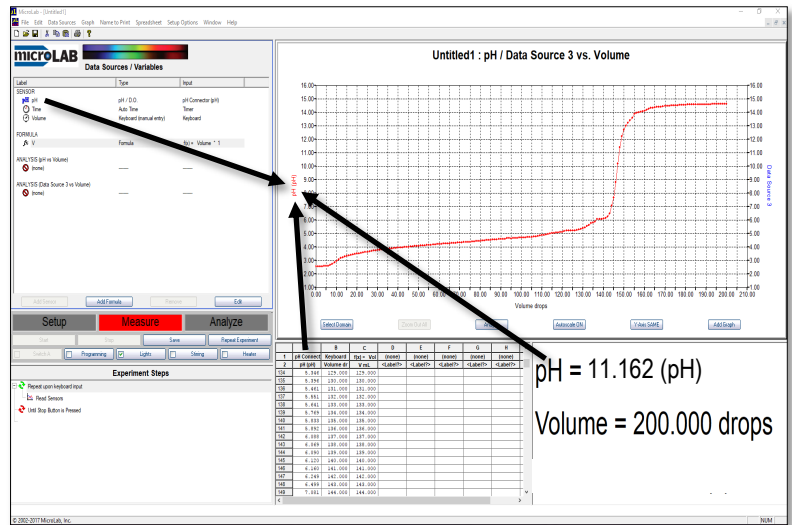
The **Graph** display provides a live graph of up to three data sources.

The **Data Table** records raw data that easily exports as a .csv file.

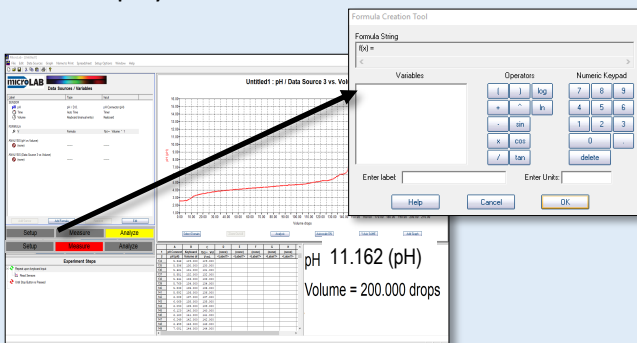
The **Digital Display** shows real time numerical values for selected data sources.

Additional graphs (up to four) and displays may be added by right-clicking anywhere in the graph window and selecting "Add New Display".

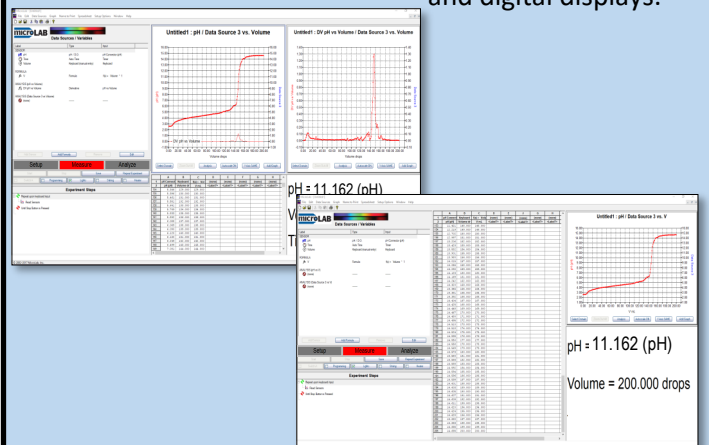
Setup **Graphs** and **Data Tables** with the drag-and-drop function for any sensor data source from anywhere on the screen to any desired location. This can be done before, during, or after an experiment has been conducted. All data collected for each sensor is automatically stored as it is collected whether or not it is currently displayed.



Students can **Add a Formula** to the display with the Formula Creation Tool. Formulas run in real time and manipulate any data sources available. Once created, the formula result can be added live to any or all of the visual displays.



The **display** can be **rearranged** to view, resize, and add up to four graphs, and additional data tables and digital displays.



Select Domain narrows the data to the area of interest for analysis

The screenshot shows the MicroLAB interface. A graph titled 'Untitled1 : pH / Data Source 3 vs. V' displays a titration curve. A 'Select Domain' dialog box is open, allowing the user to zoom into a specific region of the graph. Another dialog box, 'Add Curve Fit', is also open, showing options for different fit types (Linear, Polynomial, Exponential, Power, Log) and a preview of the fit on the data points. The fit equation shown is $y = 0.0075x + 0.2620$.

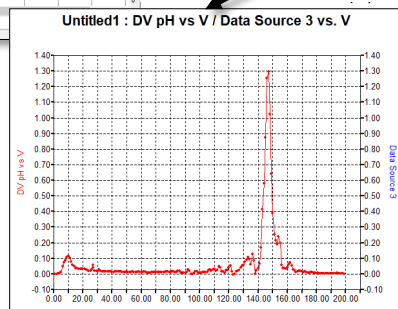
Add a Curve Fit generates an equation for a linear, polynomial, exponential, power, or logarithmic fit of the data. Data points can be easily deselected or reinstated by right-clicking the data point to evaluate "what if" scenarios.

The dialog box shows the following options:

- Add a Curve Fit
- Interpolation / Extrapolation
- Plot a Derivative (Rate of Change)
- Plot Second Derivative
- Compute an Integral

Buttons for 'Cancel' and 'OK' are at the bottom.

Plot a Derivative generates a rate of change for the data collected that can be plotted on an existing graph or on a new graph display.



Analysis inserts a curve fit, interpolation/extrapolation, derivative, or integral onto the graph.

The diagram features a central image of the MicroLAB FS-528 Laboratory Data System. It is surrounded by a large triangle containing the following text:

- Tools to Manage:** Time, Illumination, Stirring, Heating, Electrical Charge, Irradiation, Audible Alerts
- Tools to Think:** Plan Experiment, Collect Data, Visualize Graph, Analyze Evaluate
- Tools to Measure:** Temperature • Pressure • pH • Light/Spectroscopy • Counts Conductance • Voltage/Electrochemistry • Time

A good laboratory provides:

- **Physical tools** to help manage your sample and experimental conditions,
- **Electronic tools** to measure chemical behavior, and
- **Software tools** to help you plan, collect data, visualize, graph, analyze, and evaluate your experiment.

The MicroLAB FS-528 provides all of this in one integrated high-resolution, affordable package.