A Content Secondary Science Newsletter from the
Southern Nevada Regional Professional Development Program

# Science Dissected

## *Converting Labs from Verification to Inquiry - Part 1*

The following definitions come from *The Lingo of Learning*, NSTApress, 2003.

**Verification/Cookbook activities**: are hands-on science lab activities that provide students with step-by-step directions for the procedures teachers expect them to perform, as well as information about the data to collect. Leading questions or statements help students successfully pay attention to the observations desired by the activity writers. *A Cookbook activity is basically the same thing as directions for students to use to complete a demonstration.*

**Structured Inquiry activity:** the teacher gives students a (usually) hands-on problem they are to investigate, and the methods and materials to use for the investigation, but not the expected outcomes. Students are to discover the relationship and generalize from the data collected.

Many labs provided by publishers or found in enumerable teacher resources are wonderful activities. However; these labs often tend to be cookbook in nature. Often this type of lab requires little thought from the students either in the "doing" or the "conclusion." Student engagement in the activity is usually limited, along with long term retention of the relationships that were the focus of the lab.

Although verification activities have their place in the science classroom, they should not be the sole lab experience that the students have, nor even compose the majority of the type of activities that students are engaged in during the year. Considering the amount of time and energy required from the teacher to setup, run and clean-up a lab; why would teachers intentionally limit the potential impact that the lab could have on the students' educational experience through limited student engagement? One potential answer to this question is to provide the students with Structured Inquiry activities. As stated in the definition above, students are given a "problem they are to investigate." When the students are engaged in solving a problem and *not* just following a recipe, student interest and long term retention tend to increase dramatically.

Faced with the fact that the majority of labs available to teachers are cookbook or verification in nature and teachers tend to have enormous demands placed on their time, what is a teacher to do? Could I be suggesting that teachers discard "old" labs all together, or that they attempt to re-write each one with a more inquiry based approach?

No. In fact, I am suggesting that with little or no modification to the lab activity it can be easily moved from verification to Structured Inquiry. The following suggestions come from the article "Reforming Cookbook Labs," by Erin Peters, found in Nov/Dec 2005 issue of *Science Scope* p. 16 – 21.

### Key Points

- Remember there is a place for both verification and inquiry in almost any science classroom. Learn when to use each, and help the students to be successful with each.
- Small changes in a verification lab may be all that is necessary to move it to Structured Inquiry.
- If you or your students are not used to using Inquiry labs, make small changes to verification labs and gradually transition the students to a more inquiry based approach.

***The National Academies Press (NSES 1996),*** *http://www.nap.edu/openbook.php?isbn=0309053269&page=105*

***Archived Issues of Science Dissected,*** *http://www.rpdp.net/link.news.php?type=sciencedis*

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## *Converting Labs from Verification to Inquiry - Part 1 continued...*

One method that requires no modification to the lab, is simply to place the students in groups of 4 with each student having an assigned role and responsibilities in the group. "The **Principal Investigator** is responsible for overseeing the lab, for keeping all members on task, and for assuring that all members participate equally. The **Reporter** is responsible for asking the teacher questions that the group cannot answer themselves and for reporting the results of the experiment to the class. The **Recorder** is responsible for ensuring all members of the group write the correct data gathered during the lab. The **Materials Manager** is responsible for gathering the materials and for ensuring all members of the group take turns measuring or making observations." (Peters) When students are to be dependent on each other, vocalize their thoughts and ideas, and contribute to the successful completion of the activity they will be more actively engaged in the lab. When students are engaged in the lab it will not only be hands-on but minds-on as well.

Another simple way to convert a lab into structured inquiry is to "**mix up the steps**" of the lab. Have the students work either as a class or in groups to place the procedures back in proper order, before they get started. (This can be done by simply making an overhead transparency of the scramble steps, and have the class suggest the proper order with either the teacher or students writing the correct order on the transparency.) This method will force the students to actively think about what they are to do and what the expected outcome is to be.

A third approach to converting an activity is to conduct a **Teacher/Student Round Robin** to write class lab procedures. After providing the students with the "problem" they will be investigating the teacher provides the first step of the procedures to the students. Then through guided class discussion a student(s) suggests the second step. The teacher then provides the third step. This pattern continues with the teacher providing the odd numbered procedural steps and the class providing the even. In this method the teacher can help "guide" the experiment either through which student suggested procedure they add to the class generated list, or by refocusing the experiment with the procedures they propose. This method of modifying an activity forces the students to think about what the "problem" is and what information/data they are trying to gather. Students can be required to copy the procedures from the board or overhead once the class has finished writing the procedures or if this step is completed the day before the activity is conducted the teacher can cut and paste them into the body of the lab and copy them off for the students to use during the lab.

The fourth approach is identical to the one above but it is performed as a **Student/Student Round Robin**. In this approach the students work in small groups to develop their own set of procedures with each student in turn proposing the "next" procedure in their experimental process. Once the group has written their procedures they must show the procedures to the teacher to get approval prior to starting the experiment.

As with all aspect of teaching, the students must be trained. Do not expect them to go from verification to inquiry and be proficient at it after only one attempt. Explain to the students what you want, and how you expect them to accomplish the task. Guide them through the process step-by-step and then give them an opportunity to try the new method with your close supervision. As the students become more proficient at working in an inquiry environment the teacher will be able to move into the role of Facilitator and out of the role of Sage. Students will be more engaged in their learning, more responsible for what they do and what they turn in, and retention will increase.

In Part 2 we discuss additional ways to move from Traditional to Inquiry with each method becoming more inquiry based. As with all things, the use of inquiry in the classroom must be balanced with the traditional or teacher directed components. The teaching pendulum should not be stuck all the way to one side or the other. Balance is the key.

**NSTA The Science Teacher, September 2005**

**Simplifying Inquiry Instruction,** *http://www.nsta.org/publications/news/story.aspx?id=50983*