

## **PREPARING PRESERVICE TEACHERS FOR THE EXPERIMENTAL DESIGN AND DATA ANALYSIS SOL'S**

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Many elementary teachers find teaching the science Standards of Learning (SOL) difficult [1, 2]. Some are even threatened by them. Of particular concern are the SOLs related to experimental design, handling data, and the scientific method. A possible reason for this discomfort is because many of these elementary teachers have had limited-to-no exposure to experimentation. As one of the activities included under a recent National Science Foundation Science Teachers Enhancement Project (STEP) grant awarded to Hampton University in conjunction with Virginia Union University and St. Paul's College, we included a teacher science fair competition. A special workbook/text was developed for this project, and used to guide teachers through the research process; from observation, and hypothesis formation and testing through the evaluation of data and drawing conclusions from the experiment. Twenty-two teachers from the Richmond metropolitan area and King and Queen County developed individual projects (laboratory research), and prepared written reports and display boards to present their results. Projects were adjudicated by staff at the Science Museum of Virginia in a formal competition for teachers. Several teachers admitted that this was the first time that they had actually performed a full experiment. All participants agreed, at the end, that they had a much better understanding of the process, and would be better able to teach it to their students. This successful activity is being submitted to the review panel as a reproducible model which affords preservice teachers an opportunity to strengthen their research skills. It can also make teachers feel more confident, and equip them to do a better job of teaching this block of SOLs.

The Commonwealth of Virginia has adopted Standards of Learning (SOL) testing as a means of testing the effectiveness of its public schools. Beginning in 2004, students will need to pass at least six end-of-course tests in order to graduate. By 2006, at least 70 percent of a school's students must pass these tests in order for a school to retain its accreditation. If Virginia's new accreditation requirements for public schools had been in place last spring, based on the results of the Standards of Learning tests, only 39 of the more than 1800 public schools would survive [3, 4].

The situation is critical and is causing great concern and apprehension on the part of the various "stakeholders" [5]. Now that the test is in place, and has been administered, how do we prepare our students to pass it? Dr. William C. Boshier, Superintendent of Chesterfield County Schools, is considering incentives for schools that achieve. Many parents and others

do not concur; they believe that incentive money should be used differently, (i.e. to purchase materials for teachers) [6].

Some observers are suggesting that teachers need to go back to school for retooling. According to Patricia Wright, state director of secondary education, there has occurred a content change in the kindergarten through 8th grade [2]. In some disciplines, the new standards have pushed more advanced concepts into earlier grades, thus creating a situation where schools, and teachers, must play "catch-up."

What can we do, as training institutions, to assist the preservice teacher in preparing to work with the science SOLs? This paper addresses preservice training specifically for the SOLs in experimental design and the analysis of data.

Recently, under the previously mentioned Science Teacher Enhancement Project grant, funded by the National Science Foundation, twenty-two teachers, from the surrounding Richmond metropolitan area worked together, over a period of three years, to explore innovative teaching strategies for middle school students. The approach of choice was called "Science At Your Reach." The emphasis was on enlightened science teaching, while using materials which are readily available in any environment (i.e. cups, straws, cans, popcorn, etc.) When asked about their own backgrounds in designing and implementing research projects in the classroom, many, if not most, of the teachers indicated that they had either not had very much experience, or it had been so long ago that they felt inadequate in this area. In response to this, the "Teacher Science Fair" was born. Structurally, it paralleled the student science fair. Teachers were required to identify an idea, research that idea in the library, develop a hypothesis, test that hypothesis, generate data and analyze it, prepare data tables, and draw conclusions. At the end of this process, each teacher was asked to prepare a display board to present his/her findings, and stand by the exhibit to answer questions posed by judges from the Science Museum of Virginia. The project lasted about two weeks.

What began as a simple classroom/workshop activity has developed into a training unit with multiple applications. For preservice teachers, it affords them the opportunity to look at the SOLs from the vantage point of the students they will be serving. The workbook designed for this project takes the student through all the steps of the research process, and,

along the way, provides short descriptions of each stage. Through carrying out a detailed laboratory investigation, preservice teachers can master the basic scientific processes - classifying, controlling, defining operationally, interpreting data, measuring, using numbers, using space/time relationships, designing experiments, formulating models, hypothesizing, inferring, observing, predicting, and questioning.

The module provided a strong foundation in the research process, thereby reducing fear of research. This process improved classroom performance in teaching the SOLs. ■

### References

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