

Ohio Teacher Professional Development in the Physical Sciences

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Abstract. An in-service teacher program held during the summers of 2004 and 2005 is described. This program, sponsored with state funds, drew a varied group of participants to learn Modeling Instruction in physics. The workshop leaders used the state science proficiency standards and physics education research (PER) results to guide many of the workshop's activities. In 2004, the participants experienced the Modeling mechanics curriculum while pretending to be students; in 2005, the teachers worked in small teams to develop Modeling-consistent units in other areas, often utilizing PER-based materials. Indications are that the experience was valuable to the teachers and that the workshop series should be offered for a new cohort.

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INSPIRATION AND RATIONALE

This paper describes a workshop for in-service teachers. It is submitted to these proceedings, not because of any groundbreaking research that occurred in conjunction with it, but because of the ways in which the results of physics education research were utilized to make it a fulfilling and effective program.

Until recently, Ohio had few state science standards related to physical science. Two years ago, the state made a rapid transition to new standards [1] and school districts had little time to prepare. Many teachers were fairly comfortable with the old standards in biological and Earth sciences, but did not have similar preparation for addressing the new physical science standards. Due to this, many districts did not even transition their curricula immediately to the new science standards.

Looking for professional development to prepare for the new curriculum, one of our team (JC) attended a Modeling Physics Instruction workshop in North Carolina. Another of our

team (KH) had participated in the Modeling Physics project from 1995-1999. Shortly after the conclusion of the North Carolina workshop, a partnership was formed with the dean's office at Ohio State to bring Modeling to central Ohio. Note that although the university members of the team were eager to provide quality professional development programs for local teachers, it was the initiative of the high school teacher that made this hope a reality.

Funding was secured from the Ohio Board of Regents, and the workshop was specifically targeted to 9th grade physical science teachers. General opinion is that these teachers are facing the most pressure under the new state standards and 10th grade graduation examination. The standards and the new test meet the requirements of No Child Left Behind. [2]

APPLICATION OF PHYSICS EDUCATION RESEARCH

The first summer workshop was three weeks of mechanics instruction, followed by three follow-up sessions on energy during the

school year. The majority of the workshop materials and basic format, designed by Arizona State University, have been used rather uniformly for workshops throughout the country over the past decade. [3] As is true of all Modeling workshops, the first summer was structured to teach participants mechanics content and introduce them to Modeling methods. Part of the process has participants play the role of students to model how activities will transpire in the classroom. Participants eventually facilitate group discussions to build their confidence using Socratic discourse. Whiteboards are used extensively as common spaces for student groups to write lab results and problem set solutions. These are then shared with the class as a basis for promoting scientific discourse.

The second summer, 19 of the original 22 teachers returned. Participants spent most of the time working in groups of 3-5 to design a modeling instruction unit for content in their courses. Units were designed around a central model and included teacher notes, student activities, and worksheets. Additionally, each unit was required to explicitly identify the state standards it addressed. This second summer brought participants full circle, having learned from already established modeling units the first summer to using units of their own design during the school year. One of the primary goals of the second summer was to force participants to see the important features of a modeling unit and become comfortable transferring these features to a new domain. Another goal was for participants to leave with ready-to-use materials for the following year.

During both summers, daily reading and discussions brought physics education research (PER) results that were relevant to the high school physical science and physics classroom directly to participants. The first summer's readings focused on general PER results, as well as student misconceptions in mechanics. [4] The second summer's readings fit into two categories: student understanding of the topics in the teachers' curricular units [5] and general PER-based curricular innovations. [6] It was required that participants include several features from PER in their units. For example, each teacher was required to write two problems in non-traditional formats for inclusion. Furthermore, the facilitators exposed the teachers to additional research-based instructional tools, such as Weekly Reports, [7] team agreements, and other cooperative learning

tools. [8] The third goal was to present participants with best-practices and introduce them to resources that prompted professional discussion.

Professional discussions were extended by bringing in two distinguished speakers involved with PER. One was a modeling high school teacher who has done some PER; the other was a well-known PER researcher. Both speakers addressed the workshop and then met with individual groups to discuss the development of their units. Each speaker brought unique insight for participants to consider.

The professional development will continue through this coming school year via several vehicles. The participants will be teaching the mechanics content for the second time since taking the initial workshop and will work on refining their use of these materials, as well as their Socratic dialogue skills. Then, as they move into the second-semester topics, they will have the opportunity to try out the materials that they and their colleagues developed this past year and make suggestions for improvements. These activities empower the participants to conduct action research in their own classrooms. Pre- and post-test data will be taken where appropriate, validated instruments exist.

Another professional development support has been the formation of triads, based upon the work of Soter et al. [9] Participants were placed in groups of three, heterogeneously with respect to curriculum development topic. The groups met near the end of the summer session to determine what kinds of feedback they could usefully provide each other. Each teacher's classroom will be visited twice by his or her triad colleagues; grant funds will defray the cost of substitute teachers for these days. It is expected that participants will benefit not only from being observed, but also from observing others.

PROGRAM DESIGN

An exciting feature of this program is that it results from a partnership between The Ohio State University, Worthington City Schools (a suburban district) and Columbus Public Schools (an urban district). The participants have a wide range of teaching experience; coming from suburban and urban districts, with many years and few years teaching experience, with a variety of science content backgrounds, and

those for whom teaching is a second rather than a first career.

The program was tailored primarily for freshman physical science, but still met the needs of participants who teach predominantly chemistry, physics, or mathematics. The grant furnished participants with a small budget to purchase some supplies to support the implementation of modeling instruction. Each teacher also received whiteboards, markers, and teaching texts.

PROGRAM EFFECTIVENESS

As part of the formal evaluation of the program's first year, all teachers were given the FCI as a pre- and post-test. The normalized gain for this group was 0.60. Also, pre- and post-surveys indicate that teachers felt better prepared to manage their classrooms, phrase questions to encourage more open-ended investigations, use cooperative learning groups, and implement inquiry learning. Additionally, more teachers reported being a resource for their colleagues than they had been previously.

LOOKING TO THE FUTURE

Evaluation of the second year has not been completed, but anecdotal evidence suggests continuation is warranted. Current plans are to offer a first-year modeling workshop next year for a new cohort of participants. Enough interest has already been expressed by teachers through personal contacts, e-mail messages, and phone correspondences to know there is a demand. Many of the teachers that are interested heard from a colleague who was in the first cohort. The power of Modeling as a professional development program is evidenced by its spreading through word of mouth, teacher to teacher. This phenomenon is not unique to Ohio Modeling.

There was a great deal of excitement and synergy that resulted from the two summers spent together. Many participants in the first cohort wish to continue their professional development in Modeling. Currently new options are being explored as a course is charted for next year. One possibility is to host an advanced modeling workshop on another topic (e.g., electricity & magnetism, mechanical waves, or chemistry). These workshops could be a few days to three weeks in length. Some participants expressed interest in returning for

independent study to develop additional Modeling units next year. It is likely that a few outstanding participants will become facilitators. The team continues to consider ways to reach new teachers and continue professional development for program veterans.

Lastly, the workshop can provide a place for teachers with different backgrounds and teaching circumstances to come together. Many informal professional exchanges happen. The team will look to increase participant diversity by reaching out to rural districts and teachers from other parts of the state. In future years, the program will continue to bring in speakers from across the country to diversify the ideas presented in the workshop.

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