Programming Tools for Introductory Physics (PTIP) Workshop

September 30 – October 2, 2010 – Southeast Community College, Lincoln, NE

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This workshop is intended for those who are teaching students who plan to become engineers, physical scientists or technicians in technology-related industries. Recent microcomputer-based laboratory (MBL) and computational tools coupled with an activity-based physics approach provides a better method of teaching physics to these future professionals by enabling the teaching/learning process to build on students' direct experiences in the physics classroom/laboratory or studio.

Vernier Software & Technology interfaces along with various sensors, connectors, and LabVIEW software have been used extensively in MBLs to collect data or to control digital or analog lines. Additionally, Vernier has developed a number of sensors and activities appropriate for pre-engineering education (see: http://engineering.vernier.com/).

LabVIEW is a powerful graphic programming tool from National Instruments used extensively in engineering and research. Knowledge of LabVIEW is often a skill that helps students find their first job after college. LabVIEW makes creating a data acquisition and control program relatively easy and even makes possible features such as web publishing. LabVIEW makes feedback and control systems, such as temperature-controlled environments, stepper motors that respond to a sensor input, or alarms that go off when sensor limits are exceeded into manageable projects. This hands-on workshop will provide participants with an introduction to some of the basics of LabVIEW. This includes the LabVIEW environment, features, and dataflow programming so that participants can create simple applications that acquire, process, display, and store real-world data using the SensorDAQ/LabPro/LabQuest and sensors. All Vernier interfaces can be used with LabVIEW, but this workshop will focus on the use of the Vernier SensorDAQ.

Traditional Physics courses have a strong emphasis on analytical problem solving, however computational and numerical problem-solving techniques are as important for the modern engineering or science student. The 2002 AIP survey [i.Ivie & Stowe-2002] assessed graduates' work responsibilities and preparation for these provided by their physics education. The most significant discrepancies between their preparation and workplace requirements were in two areas: use of scientific software and ability to program computations. Computational modeling has emerged as an accepted, and in many STEM fields an indispensable, methodology for scientific research and engineering development. [ii. Duderstadt *et al.*-2002] For example, many science and engineering areas of research involve multi-physics modeling, where the interdependence of component processes lying in different physical domains can only be expressed in terms of couplings between separate computational models from each domain.

This workshop will show participants how they can introduce computation into their introductory courses. Participants will engage in a hands-on introduction to computational modeling in the Vpython programming language and learn to develop their own exercises and student projects. A framework for computational projects will be demonstrated along with several example projects, and a discussion of how computational modeling can be implemented in a Two Year College environment.

There will also be an opportunity to share and discuss issues relating to implementation and to teaching physics more effectively. There will be extensive discussions on how to use various strategies, tools, and tactics to overcome problems and barriers. Discussion and information on the needs of the technological workforce and its connection with the activities of this workshop will also be presented. The workshop leaders have years of experience in developing and refining curriculum for introductory physics students.

The local host will be Kent Reinhard who has implemented MBL and LabVIEW into his physics program at Southeast Community College.

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i . R. Ivie and K. Stowe, *The Early Careers of Physics Bachelors American Institute of Physics*, College Park, MD, AIP Pub. R-433.2, (2002).

ii . J. Duderstadt *et al. Issues for Science and Engineering Researchers in the Digital Age*. Ad Hoc Committee On Being A Scholar In The Digital Age, Office of Special Projects, National Research Council, Washington D.C. (2001)