Comments on D3: PHYSICS AND DISTANCE EDUCATION
(Robert Lambourne)

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Since the use of distance learning is expanding worldwide, an exploration of its educational potential in physics teaching is important. The author does a good job of summarizing the work done by UK's well-known open university in physics education. He also addresses a number of the problems that educators face in the design and implementation of distance learning courses in general and specific problems encountered in physics teaching. Thus, the article provides useful background for physics educators who are engaged in the preparation of course materials or who are acting as mentors in distance learning courses in physics.

The article fails to address the question of how recent research findings in physics education can be used in the design of more effective distance learning courses. And he does not address the question of what kind of research is needed to gauge how effective different distance learning strategies are. In particular, a large body of Physics Education Research (PER) supports the notion that the mastery of physics concepts cannot be achieved without students making predictions, observing real phenomena, and confronting the discrepancies between predictions and observations. These findings suggest that two major challenges in the design of distance learning in physics are: (1) how to provide students with real experience with physical phenomena; and (2) how to incorporate active learning strategies that include guided inquiry into real phenomena into distance learning courses.

There are several active learning strategies used in physics courses that I think could be adapted for use in distance learning:

1. *Physics with Everyday Materials:* One possibility is to consider the surroundings of students in a given course and design a series of guided inquiries that use common materials that the students involved in a given course can obtain at little or no expense. For, example a simple pendulum can be made using a string or vine tried at one end to a small object and at the other end to a low tree branch.

2. *Interactive Lecture Demonstrations:* A series of interactive demonstrations have been developed by David Sokoloff (University of Oregon) and Ronald Thornton (Tufts University). The demonstrations are designed to enhance conceptual learning in physics lectures through active engagement of students in the learning process. Students observe real physics demonstrations, make predictions about the outcomes on a prediction sheet, and collaborate with fellow students by discussing their predictions in small groups. Students then examine the results of the live demonstration (often displayed as real-time graphs using computer data acquisition tools), compare these results with their predictions, and attempt to explain the observed phenomena. Thornton and Sokoloff have been doing research on the effectiveness of web-based ILDs.

   http://www.aps.org/units/fed/newsletters/fall2003/ThorntonWebILD.html

John Wiley and Sons, a US publisher with international representatives, provides complimentary copies of their *Interactive Lecture Demonstration Guide* to physics teachers.

http://www.wiley.com/WileyCDA/WileyTitle/productCd-0471487740.html

3. *LivePhoto Physics Activities:* Short videos, often just 20 to 30 frames in length, can be extremely useful in physics teaching. These videos are not still photographs, but they are too short to be considered movies. These short videos or "live photos" are designed for computer analysis. Positions of objects in the video frames can be measured by pointing a mouse and clicking. The data can be graphed, analyzed in spreadsheets, and compared to theoretical models. The *LivePhoto Physics* Project team is creating a collection of videos and classroom-tested activities using guided inquiry techniques that embody the principles of active learning.

   http://livephoto.rit.edu/