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# PERC Report 1998 - Research in Physics Education Group, University of Nebraska - Lincoln

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From:

**Physics Education Research Conference, 1998  
Proceedings**

**Appendix D:**

**Summary of Research in Physics Education programs in 1998**

The complete report of the proceedings is online at  
<http://physics.unl.edu/~rpeg/perc98/>

## Research in Physics Education Group

University of Nebraska-Lincoln

The work of the University of Nebraska-Lincoln Research in Physics Education Group has two main thrusts. One is to examine student reasoning and the other is to use multiple forms of media to improve the teaching and learning of physics. Multiple projects are underway in the summer of 1998 which are related to these interests.

**Computer Intensive Physics Class:** This is an outgrowth of a “paperless” physics class. It is an experiment in the effectiveness of a “workshop physics”-style class in which the use of paper for transferring information (homework, tests, etc.) between student and teacher is minimized and the use of computers is maximized for all phases of learning.

**Introductory Physics Laboratories:** Since 1993, the group has worked on incorporating interactive multimedia learning activities into UNL’s introductory physics laboratories.

**Color Images of Physical Phenomena CD-ROM:** A slide collection of 360 images produced by Japanese physics educators in the late 1960s has been digitized and re-released as a CD-ROM by the UNL RPEG. New uses for the images are facilitated by their digital format and their organization in a database. This follows several other instructional materials development projects.

**International Bicycle Exchange Project:** This is an exchange program in which U.S. and European students exchange travel across the Atlantic Ocean to study the scientific and cultural aspects of the bicycle and develop multimedia materials about the bicycle.

**Graduate Research Traineeship: Using Hypermedia for Knowing Physics.** The current RPEG graduate students are supported by this NSF funded fellowship.

Visit our web site at:

<http://physics.unl.edu/research/rpeg/rpeg.html>

### University of Nebraska- Lincoln RPEG

1998-1999

*Faculty*

Robert G. Fuller

*Research Associate*

Vicki L. Plano Clark

*Graduate Students*

Rebecca Lindell Adrian

Thomas C. Koch

*Staff*

Marilyn T. McDowell

*Recent Collaborators*

V. S. Rao

Steven R. Dunbar

Amy N. Spiegel

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### **Robert Fuller—University of Nebraska-Lincoln**

The Nebraska group benefited from the existence of Ph.D. programs in other physics departments, such as the one at the University of Washington. In 1989 the physics department voted to offer Ph.D.s in research in physics education here. We got interested in this really from two different directions. ADAPT was a Piagetianbased program for college freshmen that we had here for 22 years. So we were encouraged in this direction by Robert Karplus and his work on student reasoning. At about the same time, we got interested in single concept films in the early 1970s and then we discovered videodiscs. Dean Zollman and I made the Tacoma Narrows Bridge Collapse videodisc, and then we got interested in digital databases. These two themes have been an essential part of the program at Nebraska—media, which is now called multimedia or hypermedia, and student reasoning. The projects we do at Nebraska involve both media and student reasoning. The Ph.D. theses that have been done here are really mixed methods research in the jargon of John Creswell from this morning. We're now involved in a Bicycle Student Exchange Project. Based on a class I called Computer Intensive Physics, I have a paper in draft form called "Paperless Physics? Not Yet," which I hope to submit to the *American Journal of Physics*

### **University of Nebraska-Lincoln History**

Summer 1998

The Research in Physics Education group (RPEG) at the University of Nebraska – Lincoln has its roots in the Film Loop Instruction Course (FLIC) of the early seventies. In 1972, tenured associate professor Robert Fuller led the first FLIC to teach physics faculty about using single concepts films to teach physics. In 1973 after the visit of Robert Karplus to the UNL campus, an interdisciplinary group of UNL faculty was formed to study the work of Jean Piaget. This group developed the ADAPT program, a multidisciplinary Piagetian-based program for college freshmen, directed by Fuller from 1975 until 1997.

During this time, Robert Fuller formed RPEG to study how to enhance college students' understanding of physics through the use of various media. Marilyn T. McDowell was hired as the RPEG and ADAPT project associate. The first two physics education graduate students (Thomas C. Campbell, 1977, and Scott M. Stevens, 1984) at UNL completed their degrees in science education with a physics emphasis. In the 1970s and 1980s, the work of the group was enhanced by a number of faculty who spent their sabbaticals at UNL.

During these years there was a strong emphasis in the group on faculty development workshops and on instructional materials development. During this time, Robert Fuller began collaborating with Dean Zollman of Kansas State University. Their collaboration resulted in many successful projects including, the 1979 production of ***The Puzzle of the Tacoma Narrows Bridge Collapse***, videodisc, the Annenberg videodisc projects of the 1980s, the ***Physics: Cinema Classics*** project and the ***Physics InfoMall*** CD-ROM product completed in 1995. Because of his innovations, the American Association of Physics Teachers awarded Professor Robert Fuller the 1992 Milliken Award.

During the next ten years the group continued to grow. In 1988, Christopher J. Moore joined the group as a research associate. After staying a decade as project support person, Christopher recently left the group for a position in Madison, WI. In 1989 the UNL physics department voted to permit physics dissertations with research in physics education. The first two students to complete such degrees were Weijia Zhang, 1996, , and Brian Adrian, 1997. In 1993, Vicki Plano Clark joined the physics department as a part-time laboratory manager and a part-time member of the RPEG. In 1994 the RPEG received NSF support for a graduate research traineeship (GRT) Ph.D. program in physics: ***Using Hypermedia for Knowing Physics***. This fellowship allowed funding for five doctoral students to complete their dissertations in physics education research at UNL. To date, the following students have received GRT fellowships: Brian Adrian (1994-1997), Rebecca Lindell Adrian (1996-present) Cecilia Hernández (1996-1998) and Thomas Koch (1997-present). Currently RPEG is involved in many curriculum and development projects.

Since 1993, the group has worked on incorporating interactive multimedia learning activities into UNL's introductory physics laboratories. In 1995, in cooperation with Steve Dunbar, UNL mathematics professor, the Multimedia Mathematics Across the Curriculum (MMATC) project was started. As part of MMATC, the group taught an experimental "paperless" physics course using the ***Physics InfoMall*** as an electronic textbook with multimedia and Maple learning activities. This project is continuing. The work of the UNL RPEG continues to combine an interest in the intellectual development of college students and the use of various media for teaching physics.

#### **Ph.D.s Awarded**

Campbell, Thomas C., 1977, An Evaluation of a Learning Cycle Intervention Strategy for Enhancing the Use of Formal Operational Thought by Beginning College Physics Students, University of Nebraska-Lincoln, Fuller, Education. Now at Illinois Central College.

Stevens, Scott Michael, 1984, Surrogate Laboratory Experiments: Interactive Computer/Videodisc Lessons and their Effect on Students' Understanding of Science, University of Nebraska-Lincoln, Fuller, Education. Now at Carnegie Mellon University.

Zhang, Weijia, 1996, Using Multimedia to Teach Optics to College Students, University of Nebraska-Lincoln, Fuller, Physics. Now at Flomerics, Austin, Texas.  
Adrian, Brian W., 1997, Using Multimedia to Teach College Students the Concepts of Electricity and Magnetism, University of Nebraska-Lincoln, Fuller, Physics. Now at Bethany College, Lindsborg, Kansas.