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EDUCATION

Doctoral Candidate, Curriculum and Instruction Degree anticipated June 2004
University of Minnesota, Twin Cities Campus
College of Education and Human Development
Field: Science Education; Concentration: Physics Education
Dissertation: An Explanatory Model of Physics Faculty Conceptions
About the Problem-Solving Process
Advisor: Patricia M. Heller

M.S., Physics December 1999
University of Minnesota, Twin Cities Campus
Field: Experimental Condensed Matter; Concentration: Magnetism
Project: Magnetic Force Microscopy of Signature Erasure in Magnetic
Recording Media
Advisor: E. Dan Dahlberg

B.S., Physics December 1997
University of Minnesota, Twin Cities Campus

PROFESSIONAL EXPERIENCE

Research

Ph.D. Research 2001 - Present
Department of Curriculum and Instruction, University of Minnesota
I investigated physics instructors' beliefs about the problem-solving process in introductory physics courses. This included analyzing interview data, developing an initial explanatory model, and refining and modifying the initial model with an expanded sample. The data analysis was done using the qualitative software package NVivo, the concept mapping software Inspiration, and Microsoft Excel.

Research Assistant

2000 - Present

Physics Department, University of Minnesota

I collected and analyzed data to help evaluate the use of cooperative group problem solving in the introductory calculus-based physics courses. This included evaluation of student performance on written problems as well as using SPSS and Microsoft Excel for the statistical analysis of multiple-choice tests (i.e., FCI, MBT, CSEM, etc.). I also collected and analyzed survey data for the purposes of informing the restructuring of the introductory physics courses for biology majors. In addition, I managed the dissemination of information about these curriculum development projects as website administrator for the Physics Education Research and Development Group.

M.S. Research

1999

Physics Department, University of Minnesota

I studied the erasure behavior of bit transitions in high-density particulate magnetic recording media by imaging, using a multimode magnetic force microscope, the bit magnetization pattern in applied, incremental sequence of *in situ* magnetic fields. I found that the erasure occurred largely at a field close to that of the measured bulk coercivity of the material, and that the regions of the media that exhibited larger than normal surface roughness were more likely to be affected by smaller fields.

Undergraduate Research

Summer 1996

Astronomy Department, University of Minnesota

I conducted image analysis of the Shoemaker-Levey 9 collision with Jupiter using the Image Reduction and Analysis Facility (IRAF) software. It was used primarily to remove the instrument and telescope “signatures” from the digital images of the event.

Teaching**Co-Instructor, Incoming TA Orientation**

Fall 1999 - 2003

Physics Department, University of Minnesota

The 2- to 3-weeklong orientation was designed to familiarize incoming physics graduate students, who will hold teaching assistantship positions, with the pedagogical practices of the physics department. Operating under the Cognitive Apprenticeship Theory, the orientation provides an opportunity for the students to learn about the theoretical aspects of teaching laboratories and problem-solving sessions, and also practice what they've learned in preparation for, in many cases, their first teaching experience.

- Scientist, Astronomy Summer Camp** Summer 2002
 Science CentrUM, University of Minnesota
 I developed and conducted a weeklong astronomy curriculum for 4th through 6th grade children. The curricular material were reviewed and sequenced to provide an enriched hands-on, minds-on experience for the students. The curriculum adhered to several suggestions of the Project 2061 Science Benchmarks.
- Co-Instructor, Returning TA Orientation** Fall 2000
 Physics Department, University of Minnesota
 The daylong orientation was implemented for the sole purpose of introducing more in-depth analysis of teaching practices for those teaching assistants who have already had a yearlong experience in the classroom.
- Mentor, Graduate Teaching Assistants** 1999 - 2000
 Physics Department, University of Minnesota
 My duties included continual evaluation of the teaching assistants during the course of the academic year, and provided on-going confidential feedback on their individual teaching performances. I also led a weekly TA seminar as a continuation, or supplement, to the orientation, during which large-scale conversations were held in discussing various theoretical and practical issues with respect to teaching.
- Teaching Assistant, Physics for Elementary Education** 1999 - 2000
 Physics Department, University of Minnesota
 I provided instructional and technological support for the course designed for elementary education majors. The course utilized the microcomputer-based Constructing Physics Understanding curriculum, and operated under the instructional pedagogy of Guided Inquiry.
- Teaching Assistant, Physics for Engineers** 1997 -1999
 Physics Department, University of Minnesota
 I was an instructor for weekly laboratory and problem-solving sessions, within a cooperative working environment, for various courses in the introductory calculus-based physics sequence.
- Head Teaching Assistant, Introductory Astronomy** 1996 -1997
 Astronomy Department, University of Minnesota
 I developed and refined the Active Learning Sessions activities, and led instructional team meetings.
- Teaching Assistant, Introductory Astronomy** 1995 -1997
 Astronomy Department, University of Minnesota
 I was an instructor for weekly Active Learning Sessions within a cooperative working environment.

Laboratory Development

Laboratory Development, Introductory Calculus-Based Physics Summer 1999
Physics Department, University of Minnesota

I developed and refined computer-based laboratory experiments for the introductory calculus-based physics sequence that were implemented during the conversion from a quarter-based to a semester-based academic calendar. The new experiments developed included problems dealing with statics and rotational dynamics.

Laboratory Development, Introductory Honors Physics Summer 1997
Physics Department, University of Minnesota

I tested and refined computer-based laboratory experiments for the introductory calculus-based honors physics sequence.

Laboratory Development, Introductory Calculus-Based Physics 1996 -1997
Physics Department, University of Minnesota

I developed, refined, and rebuilt laboratory equipment for the introductory calculus-based physics sequence.

PUBLICATIONS

Henderson, C., Heller, P., Yerushalmi, E., & Kuo, V.H. (in preparation). Is There a Mismatch Between Physics Faculty Conceptions and Research-Based Instructional Strategies?

Henderson, C., Yerushalmi, E., Heller, P., Kuo, V.H., & Heller, K. (in press). Grading Student Problem Solutions: The Challenge of Sending A Consistent Message, *American Journal of Physics*.

Henderson, C., Heller, K., Heller, P., Kuo, V.H., & Yerushalmi, E. (2002, August). Students Learning Problem Solving in Introductory Physics: Forming an Initial Hypothesis of Instructor's Beliefs, *Proceedings (Peer Reviewed) of AAPT Physics Education Research Conference* (Boise, ID).

Kuo, V.H., Heller, K., Heller, P., Henderson, C., & Yerushalmi, E. (2002, August). Teaching Students Problem Solving in Introductory Physics: Forming an Initial Hypothesis of Instructor's Beliefs, *Proceedings (Peer Reviewed) of AAPT Physics Education Research Conference* (Boise, ID).

Henderson, C., Heller, K., Heller, P., Kuo, V.H., & Yerushalmi, E. (2001, July). Instructors' Ideas about Problem Solving – Setting Goals, *Proceedings (Peer Reviewed) of AAPT Physics Education Research Conference* (Rochester, NY).

Heller, P., Heller, K., Henderson, C., Kuo, V.H., & Yerushalmi, E. (2001, July). Instructors' Beliefs and Values about Learning Problem Solving, *Proceedings (Peer Reviewed) of AAPT Physics Education Research Conference* (Rochester, NY).

Kuo, V.H., Heller, K., Heller, P., Henderson, C., & Yerushalmi, E. (2001, July). Instructors' Ideas about Problem Solving – Grading, *Proceedings (Peer Reviewed) of AAPT Physics Education Research Conference* (Rochester, NY).

Kuo, H.V., Merton, C.A., & Dahlberg, E.D. (2001). Magnetic Force Microscopy Studies of Bit Erasure in Particulate Magnetic Recording Media, *Journal of Magnetism and Magnetic Materials*, 226-230, p. 2046-2047.

Yerushalmi, E., Heller, K., Heller, P., Henderson, C., & Kuo, V.H. (2000, August). Why Solve Problems? – Interviewing College Faculty About The Learning And Teaching Of Problem Solving, *Proceedings (Peer Reviewed) of Physics Teacher Education Beyond 2000 International Conference* (Barcelona, Spain).

PRESENTATIONS

Invited

“Using Grounded Model Construction & Explicit Analysis Methods to Converge towards an Explanatory Model of Physics Faculty Conceptions about Problem Solving”, Invited Poster for Targeted Poster Session on Problem Solving Research Methodology, Physics Education Research Conference, Madison, WI, August 2003.

“Locus of Control: What do They Mean for Introductory Physics?” Invited Talk, Physics Education Research Seminar, Physics Department, University of Minnesota, Summer 2003.

“Instructors' Conceptions of Problem Solving”, Invited Talk for Physics Department Colloquium, University of North Dakota, Grand Forks, April 4, 2003.

“Analyzing Student Written Communications”, Invited Talk, University of Minnesota, Crookston, April 3, 2003.

“Epistemology in Physics Education: What Is It and Why Should We Care?” Invited Talk, Problems of Physics Teaching and Higher Education Seminar, Physics Department, University of Minnesota, February 2002.

Contributed

“Clinical Interviews & Multi-layered Concept Mapping”, Contributed Paper for Round Table Discussion on Research Methodology, Physics Education Research Conference, Madison, WI, August 2003.

“Locus of Control – Chance or Self-Attribute?” Contributed Talk, American Association of Physics Teachers Summer Meeting, Madison, WI, August 2003.

“Solving a Physics Problem – An Expansion of Instructors’ Beliefs”, Contributed Talk, American Association of Physics Teachers Winter Meeting, Austin, TX, January 2003.

“Helping Students Learn Problem-Solving – Forming An Initial Model of Instructor’s Beliefs”, Contributed Talk, American Association of Physics Teachers Summer Meeting, Boise, ID, August 2002.

“Helping Students Learn Problem-Solving – Forming An Initial Model of Instructor’s Beliefs”, Contributed Poster, Physics Education Research Conference, Boise, ID, August 2002.

“Instructors’ Beliefs about Learning and Teaching through Example Problem Solutions”, Contributed Talk, Minnesota Area Association of Physics Teachers Spring Meeting, St. Peters, MN, April 2002.

“What do Students Learn from Example Problem Solutions? Instructors’ Beliefs”, Contributed Talk, American Association of Physics Teachers Winter Meeting, Philadelphia, PA, January 2002.

“Instructors’ Ideas about Problem Solving – Grading”, Contributed Talk, American Association of Physics Teachers Summer Meeting, Rochester, NY, July 2001.

“Instructors’ Ideas about Problem Solving – Grading”, Contributed Poster, Physics Education Research Conference, Rochester, NY, July 2001.

“Analyzing Student Lab Reports”, Contributed Talk, American Association of Physics Teachers Winter Meeting, San Diego, CA, January 2001.

“Analyzing Student Lab Reports”, Contributed Talk, Minnesota Area Association of Physics Teachers Fall Meeting, Duluth, MN, October 2000.

“More Physics with Less Equipment”, Contributed Talk, American Association of Physics Teachers Winter Meeting, Kissimmee, FL, January 2000.

“Magnetic Force Microscopy of Bit Erasure in Magnetic Recording Media”, Contributed Poster, International Conference on Magnetism 2000, Recife, Brazil, August 2000.

“Magnetic Force Microscopy of Bit Erasure in Magnetic Recording Media”, Contributed Talk, American Physical Society March Meeting, Minneapolis, MN, March 2000.

Workshops

"Teaching Assistants: Getting them Ready and Supporting their Teaching", Workshop Co-Leader, American Association of Physics Teachers Winter Meeting, Austin, TX, January 2003.

"Writing in Physics – Student Laboratory Reports", Co-Leader, Workshop for Minneapolis Area High School English Teachers, Minneapolis, MN, March 2002.

"Computer-Based Problem Solving Laboratories for Introductory Physics", Workshop Co-Leader, American Association of Physics Teachers Summer Meeting, Rochester, NY, July 2001.

"Computer-Based Problem Solving Laboratories for Introductory Physics", Workshop Co-Leader, Lab-Centered Instruction Conference, Grand Rapids, MN, June 2001.

"Computer-Based Problem Solving Laboratories for Introductory Physics", Workshop Co-Leader, American Association of Physics Teachers Winter Meeting, San Diego, CA, January 2001.

PROFESSIONAL SERVICE

Organizer, Graduate Student and Post Docs in Physics Education Research Crackerbarrel, American Association of Physics Teachers Summer Meeting, Madison, WI, August 2003.

Manuscript Reviewer, Proceedings of Physics Education Research Conference, August 2002.

Committee on Academic Uses of Technology Member, College of Education and Human Development, University of Minnesota, Fall 2001 to Summer 2003.

Graduate School Academic Grievance Committee Member, University of Minnesota, December 2000 to December 2002.

Website Administrator, Physics Education Research and Development Group, University of Minnesota, January 2000 to present (Listed as a recommended website in the WebSights Column. *The Physics Teacher*, Vol. 40, October 2002, p. 447).

Computer Administrator, Physics Education Research and Development Group, University of Minnesota, January 2000 to present.

Policy and Review Chair for Education and Psychology, Council of Graduate Students, University of Minnesota, Summer 2000 to Summer 2001.

PROFESSIONAL MEMBERSHIPS

Minnesota Area Association of Physics Teachers (MAAPT)	2000 - Present
American Association of Physics Teachers (AAPT)	1999 - Present
American Physical Society (APS)	1999 - 2001

REFERENCES

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