F2011 Mathematics, Science & Technology FACULTY RESEARCH GROUPS

DOR ABRAHAMSON
Embodied Design Research Laboratory
EDUC 223B 012 | CCN 24058 | Open to all students
Tuesday, 3-5P M in 4648 Tolman
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EDRL, the Embodied Design Research Laboratory research group, began functioning in the spring of 2006. The group's research is characterized by a theoretical strain (embodied cognition), a methodological line (design-based research), and a disciplinary emphasis (mathematics). Thus, the laboratory hosts the full cycle of design-research projects that are geared to contribute to theory and practice of multi-modal mathematical learning and reasoning as well as to design theory.

Research-group participants share and present for discussion their own design-related work as they progress from tackling a design problem through to design, implementation, data analysis, and writing up for publication. In this research group, we: (a) design, build, and field-test learning environments that foster K-16 students' inquiry-based learning of targeted mathematical concepts; (b) develop methodologies that enable us to elicit the data we need for inquiring into questions that go beyond "Did it work?" to exploring how and why things work; (c) analyze videotaped data and student artifacts to contextualize discussions of relations between objects, media, activities, perception, and reasoning; and (d) draw on relevant literature, such as work pertaining to design frameworks, to improve our designs, enrich our interpretation of data, and articulate and present our work such that it addresses the needs and interests of a broad community of education researchers and practitioners.

ANDREA A diSESSA
BOXER/PATTERNS Research Group
EDUC 223B 001 | CCN 24028 | Open to all students
Thursdays, 3 -5PM in 5608 Tolman
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The Boxer/Patterns Research Group deals with two long-term themes: (1) conceptual development, mainly in science and (2) computer learning environments, especially approaches to a deep computational literacy for all. For 2011-2012, the main work will be a continuation of the Patterns Project (described below), which will be directed toward engaging diverse and marginalized student populations.

The “Patterns of Change and Control” (aka “Patterns”) Project is investigating a “bottom up” version of curriculum development. “Bottom-up” means we are spending a great deal of time studying the naïve knowledge state, looking mainly for secure footings for learning. The topic, “patterns…” concerns familiar phenomena such as balance, equilibration, “tipping point,” oscillation, pumping, resonance, stickiness, and so on. The goals of our instruction are to parlay this naïve knowledge into understanding a slice of the professional domain of “dynamical systems theory.” We have found a lot of naïve competence in this area, characterized it, and have been building instructional strategies based on it.

Research questions in the project include: what characterizes “natural learning paths” from students intuitive knowledge into technical competence?; how abstract are student ideas?; and what is the role of computer representations in learning? Building on prior work, our new work with different student populations will ask: are there deep cultural differences in intuitive

knowledge in physics?; how much does intuitive knowledge of psycho-social patterns overlap with physics?; are there cultural differences in "meta-skills" of, for example, developing clear and precise verbal descriptions of patterns? Aside from the main project, all students are welcome to come learn about doing research by bringing their own and helping others do theirs.

RANDI A ENGLE
The Discourse Interaction and Learning Lab (DILL)
EDUC 223B 011 | CCN 24055 | Open to all students
Fridays, 1-3PM in 4648 Tolman
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Research meetings of the Discourse, Interaction and Learning Lab (DILL) are open to anyone interested in investigating how learning occurs through discourse or other forms of social interaction. My own research focuses on these issues in the context of teaching and learning in mathematics and biology, but folks interested in other disciplines are welcome as well. Each Friday afternoon there is time both for students to get feedback on work-in-progress as well as to participate in ongoing research projects with me and my colleagues.

Our main meeting is every Friday 1-3, which is when students share their work-in-progress with each other. There will also be two weekly research meetings after the main DILL meeting related to an NSF-funded project that is investigating ways of fostering the transfer-of-learning. One group will be conducting and/or designing tutoring experiments to test my hypotheses about how framing influences transfer in both biology and mathematics. A second group will be analyzing data from a high school biology teacher who already employs many aspects of the expansive framing in his classroom instruction.

MARCIA C LINN
Technology Enhanced Learning in Science
EDUC 223B 002 | CCN 24031 | Open to all students
Tuesdays, 3:30 PM - 5:30 PM in 3515 Tolman
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This fall our research group will focus on two main topics: cumulative science learning around the topic of energy and ways to take advantage of powerful scientific visualizations embedded in inquiry projects. In addition, we will be planning for our newly funded research on automated inquiry guidance. Our group interacts as a partnership where experts in research, classroom teaching, student and teacher learning, science disciplines, technology, curriculum, and educational policy jointly design and investigate ways to take advantage of technology to improve science learning and instruction. Each group member contributes to the professional development of the others.

Research group activities include: Review of members research findings, planning of research studies, design of professional development programs, design of assessments and curriculum

materials, development of effective research methods, critical friend feedback on papers, proposals, or designs, and discussions of research papers.

Group members have: (1) designed artifacts such as models or simulations of complex phenomena, assessments to measure the impact of innovations, and learning environments that support students as they carry out complex activities. (2) Observed how students and teachers use new technologies including programming software, models, simulations, and learning environments, (3) studied ways to orchestrate student and teacher interactions with science activities, (4) paid special attention to issues of equity and diversity since both science and technology have been stereotyped as male domains and since access to technology varies with economic resources in our culture.

KATHLEEN METZ
Children's Scientific Cognition and Instruction
EDUC 223B 003 | CCN 24034 | This research group is open to new members.
Monday, 4-6 & Tuesday, 1-4 in 4603 Tolman
kmetz@berkeley.edu http://www-gse.berkeley.edu/faculty/KMetz/KMetz.html

Our research group focuses on K-8 science, with an emphasis on the elementary school. Most members of the group are involved in some way with a research project exploring the interplay of development, learning and instruction in the context of the teaching of evolution (microevolution) to inner-city 2nd and 3rd graders.

Children in our project have participated in either one or two curriculum modules we wrote to scaffold their understanding and application of ideas of evolution in the context of the practices of science. A learning progression model that aims to leverage children's fruitful intuitions in this conceptual terrain and strategically build toward more powerful understandings underlies both the curriculum modules and analysis of interviews. At this point, we have finished data collection in public school classrooms and project-run summer schools. We are now primarily focused on analyzing the pre- & post structured-interviews to assess the children's understanding of evolution, as reflected in problems of fit between organisms and their environment and cases of microevolution. Individuals or subgroups of the team are undertaking complementary analysis using the video database of interviews and/or classroom implementation.

The group has presented papers at AERA, National Association for Research in Science Teaching, and the Jean Piaget Society.

Monday 1-4: This meeting is completely devoted to this research project. All members are actively involved in the core analysis of the structured interviews for children's understandings of ideas of evolution, in accordance with a detailed coding book the team has collaboratively developed.

Tuesday 1-4: This second weekly meeting is designed for collaborative consultations for other analyses using this database, as well as student position papers and dissertations within the realm of children's scientific cognition and instruction, or the teaching and learning of biology at higher grade levels.

F2011 Mathematics, Science & Technology FACULTY RESEARCH GROUPS

MICHAEL A RANNEY
The Reasoning Group
EDUC 223B 006 | CCN 24043 | Open to all students
Fridays, 1PM – 3PM in 4529 Tolman
ranney@soe.berkeley.edu
Web site: http://www-gse.berkeley.edu/faculty/MRanney/MRanney.html

The Reasoning Group, headed by Michael Ranney, is currently open to all.

Historically, it has had a very broad scope, studying the variety of ways in which people reason about science, math, and society. A central, continuing, theme involves assessing, understanding, and/or improving the coherence of (often socially relevant) scientific arguments and explanations. One of the group's sub-themes focuses on a general numeracy project we call Reasoning With Numbers (which has both descriptive and prescriptive flavors)--but it is hardly just about numbers and it is hardly traditional math-education research.

We look at how people reason about, and with, numerical propositions–-for instance, the immigration, murder, death-penalty, taxation, or abortion rates--along with other content/ knowledge propositions. (The project's Numerically Driven Inferencing paradigm often involves a procedure in which we provide an actual rate as feedback once people have generated an estimate, then see how it changes folks' minds--but we have been using variants of that procedure, as well.) We tend to focus on numbers that have policy implications, and have analyzed journalists' numerical reasoning ("Journalism with Numbers"), and how to improve it; the goal of the curricular element is to improve news reporting and thus improve the knowledge base of those who consume news--that is, virtually all of us. Finally, a related and central Reasoning Group sub-theme involves cognition about global warming and evolution—as well as how and why societies differ in accepting these notions. Some of our most recent studies assess Americans' (modest, it turns out) understanding of the mechanism of global climate change--and how much people change their beliefs when provided such mechanistic information. Much of this sub-theme is related to our RTMD (Reinforced Theistic Manifest Destiny) theory.

In general, most sciences and mathematics—end even a bit of historical analysis—are ripe for study within the current Reasoning Group. Generally, Reasoning meetings are a mixture of (a) reports on ongoing or planned research,(b) reality-testing about such research (e.g., about designs or materials), and (c) "journal club" activities, in which we decide which readings from the literature we will collectively address.

Default participation in Reasoning is for two units of S/U or P/NP credit for EDUC 223B, sec. 06; letter-grades and more units are possible via negotiation. Folks are welcome to stop by, hang for a while, and see what's up.

F2011 Mathematics, Science & Technology FACULTY RESEARCH GROUPS

GEOFFREY SAXE
MARYL GEARHART
Learning Mathematics through Representations (LMR)
ED 223B 007 | CCN 24046 | Participation only with approval of instructor
Day & Time TBD
saxe@berkeley.edu gearhart@berkeley.edu
Web site: http://gse.berkeley.edu/faculty/gsaxe

Learning Mathematics through Representations (LMR) research group is engaged with developing and studying a research based curriculum unit on integers and fractions for the upper elementary grades. The research component that has proceeded in concert with the curriculum development effort includes three strands of empirical work: interview studies investigating children's understandings of integers and fractions using structured clinical interview techniques; tutorial studies investigating teaching strategies that may help children build upon their mathematical understandings and strategies; and classroom studies that provide formative information on the effectiveness of pilot lessons using a range of measures (observation, student work, teacher and student interviews) as well as analyses of the travel of ideas in classroom communities. Collectively these three strands guide formative decisions about the design and improvement of the LMR curriculum.

LMR research group members participate in all phases of the research: design of studies, collection of interview and tutorial data, creation of coding schemes for analyses of interview and tutorial videotapes, coding using (using and learning to use) qualitative software packages (e.g., StudioCode, FileMaker Pro), drawing packages (Omnigraffle, DeltaGraph), and analysis of coded data using statistical packages (e.g., SPSS), and preparation of articles for scholarly journals and chapters in edited volumes. LMR research group members also participate in discussions of LMR work-in- progress with faculty, collaborating teachers, and our consultants (Deborah Ball and Hyman Bass, Univ. of Michigan), and every summer LMR faculty and a group of research group members attend the Elementary Mathematics Laboratory at the University of Michigan to work with our Michigan colleagues. In the final year of the current project (2010-2011), a summative investigation of the overall success of the novel curriculum will consist of an experimental study that contrasts the outcomes for students working with the LMR curriculum vs. district-mandated textbooks; analysis of the resulting implementation and achievement data will involve hierarchical linear modeling.

The group has regularly presented papers and symposia of ongoing work at professional conferences, including AERA, NCTM, PME, and EARLI, sometimes in collaboration with our colleagues at other institutions, like the Michigan group.

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ALAN H SCHOENFELD
Functions Research Group
EDUC 223B 004 | CCN 24037 | Open to all students
Tuesdays, 1PM-3PM in 5612 Tolman
alans@berkeley.edu **Web site: http://functions.berkeley.edu**

The Functions Group serves as research forum for people interested in varied aspects of mathematical cognition. In fundamental ways, its agenda is to serve the research needs of its members. Thus, on demand, we may have sessions of the following types:

(1) Someone may want feedback on a draft of a course paper, a research plan, a dissertation proposal, a dissertation chapter, or a paper to be submitted for publication. The work will be distributed to the group, and we will go over it together.

(2) Someone may have a bit of data that is puzzling or problematic; or, he or she may want to try an analysis on us and see if we find it plausible. In that case, we have a working session.

(3) There is a consensus that we should read and discuss a particular paper or papers, or discuss current (mathematical/political) events.

(4) People give practice talks of all kinds: rehearsals for AERA, PME, NCTM, job talks, etc.

ALAN H SCHOENFELD
Algebra Teaching Study Research Group
EDUC 223B 005 | CCN 24040 | Potentially open to all students (see instructor)
Tuesdays, 9-11AM in 5612 Tolman
alans@berkeley.edu **Web site: http://ats.berkeley.edu**

The Algebra Teaching Study Research Group is concerned broadly with effective mathematics teaching, and more narrowly with the teaching of (a) middle school algebra word problems, and (b) practices that are effective for a wide range of diverse students. This is part of an NSF-funded project conducted jointly with Bob Floden at MSU, and we will meet in videoconference with our MSU colleagues. From the NSF proposal: "Specifically, we propose to explore the following two questions: (1) What instructional practices are frequently used by teachers judged to be doing an exceptional job of helping students to develop proficiency in solving word problems? and (2) What analytic procedures can be developed and used to characterize these promising teaching practices, with low enough cost so that connections between teaching and learning can be examined for a large number of classrooms? We will examine the instructional practices of carefully selected master teachers, seeking to identify practices that result in powerful student learning."

The agenda will evolve as our understandings of how to address the questions in the previous paragraph develop.