ILLINOIS
LEARNING SCIENCES
DESIGN LABORATORY

A Lightning Symposium

ILLINOIS

Toward an Illinois Learning Sciences Design Laboratory

A Lightning Symposium

February 27, 2015 - 8:00 AM – 2:30 PM

Hyatt Place Champaign/Urbana
217 N. Neil Street, Champaign, IL 61820
Meeting Place A, B, C and D

Acknowledgement

This symposium was made possible thanks to the generous support
of the College of Education at the University of Illinois at Urbana-Champaign

Program at a Glance

8:00–8:30 a.m.	Coffee Service
8:30–9:00 a.m.	Opening Session
9:00–9:45 a.m.	Session I–Lightning Talks
9:45–10:00 a.m.	Break
10:00–11:15 a.m.	Session II–Interactive Posters, Round Tables, and Demonstrations
11:15 a.m.–12:00 p.m.	Session III–Lightning Talks
12:00–1:00 p.m.	Lunch
1:00 –1:15 p.m.	Break
1:15–2:20 p.m.	Session IV–Lightning Talks
2:20–2:30 p.m.	Closing Remarks–Next Steps

Overview

The Visioning Future Excellence at Illinois Outcomes Report (2013) put forth the development of a Learning Sciences Laboratory among the New Strategic Investment Initiatives for campus. The laboratory aims "to understand learning mechanisms and to invent learning and educational tools, practices, and spaces for the future of teaching and learning across disciplines and professions" (p. 11).

This symposium is a major first step toward articulating a coherent framework, and an encompassing vision and plan for an Illinois Learning Sciences Design Laboratory (ILSDL). The symposium will help identify faculty and research groups across the University of Illinois at Urbana-Champaign campus who would bring to this initiative deep and varied expertise in research, design, development, and tool creation; and who currently are operating within departments, schools, colleges, centers, institutes, and start-ups across campus. Leveraging our wealth of expertise in a creative, collaborative, trans-disciplinary, and enabling laboratory environment is key to ensuring Illinois excellence and leadership in the context of an increasingly prominent global focus on the implications of the learning sciences for designing learning environments.

The symposium is structured to showcase the work of faculty and research groups, facilitate discussion among participants, build networks, and initiate a number of specific proposals for seed funding. Our goal is to be generative of ideas addressing grand challenges in design and tool creation for teaching and learning, and to create a network of design and research collaborations across campus. These grand challenges include: (a) Advancing the scientific understanding of learning; (b) Designing tools, environments, and platforms (physical, online, virtual, simulations, visualizations, etc.) to improve/deepen/accelerate learning, and learning processes and outcomes; and (c) Designing tools to analyze big data with the aim of transforming uniform learning platforms into adaptive personalized learning environments.

Symposium Program Review Committee

Fouad Abd-El-Khalick, College of Education, Chair

Gabrielle D. Allen, National Center for Supercomputing Applications

Aron K. Barbey, College of Applied Health Sciences and Beckman Institute

David Brown, College of Education

Steven A. Culpepper, College of Liberal Arts and Sciences

Lisa W. Hinchliffe, University Library

H Chad Lane, College of Education

Robb Lindgren, College of Education

Bruce J. Litchfield, College of Engineering

Emma Mercier, College of Education

John M. Toenjes, College of Fine and Applied Arts

Lav R. Varshney, College of Engineering

Michael B. Twidale, Graduate School of Library and Information Science

Program

8:00–8:30 a.m. Coffee Service

8:30–9:00 a.m. Opening Session

Welcome and Overview

Fouad Abd-El-Khalick
Associate Dean for Research & Research Education, College of Education

Keynote Remarks

Peter Schiffer
Vice Chancellor for Research, University of Illinois at Urbana-Champaign

Mary Kalantzis
Dean, College of Education

Andreas Cangellaris
Dean, College of Engineering

Edward Seidel
Director, National Center for Supercomputing Applications

9:00–9:45 a.m. - Session 1

1.01 Can a Robot Learn Language as a Child Does?
Levinson, Stephen; selevins@illinois.edu; Electrical and Computer Engineering; Beckman Institute

1.02 Computational Metacognition
Twidale, Michael; twidale@illinois.edu; Graduate School of Library and Information Science

1.03 Cloud Sharing of IOLab Data to Enable Collaborative Online Labs
Selen, Mats; mats@illinois.edu; Physics; College of Engineering
Stelzer, Tim; tstelzer@illinois.edu; Physics, College of Engineering

1.04 Movement Influences Emotional Responses to Stimuli Viewed On Mobile Phones
Wise, Kevin; krwise@illinois.edu; Advertising; College of Media
Ren, Yilin; yren14@illinois.edu; Advertising; College of Media
Wang, Zongyuan (Glenn); zwang101@illinois.edu; Advertising; College of Media
Zheng, Anlan; azheng6@illinois.edu; Advertising; College of Media

1.05 Big Data Comes to School: Reconceptualizing Evidence and Research in the Era of Tecnology-mediated Learning
Cope, William; billcope@illinois.edu; Education Policy, Organization and Leadership; College of Education
Kalantzis, Mary; kalantzi@illinois.edu; Curriculum and Instruction; College of Education

1.06 Team Learning through Networked Communication and Game Actions
Yahja, Alex; alexy@uiuc.edu; Institute for Computing in the Humanities, Arts, and Social Sciences; National Center for Supercomputing Applications
Pilny, Andrew; apilny2@illinois.edu; Communication; College of Liberal Arts and Sciences
Poole, Marshall Scott; mspoole@illinois.edu; Communication; College of Liberal Arts and Sciences

1.07 Classrooms as Device Ecologies: Designing Technology to Support Collaborative Learning in Classrooms
Mercier, Emma; mercier@illinois.edu; Curriculum and Instruction; College of Education

1.08 Utilizing Tools from Network Science and Machine Learning to Understand the Structure and Malleability of Brain Networks
Nikolaidis, Aki; g.aki.nikolaidis@gmail.com; Beckman Institute
Goatz, Drew; goatz2@illinois.edu; Bioengineering; College of Engineering
Smaragdis, Paris; paris@illinois.edu; Computer Science; College of Engineering
Kramer, Arthur; a-kramer@illinois.edu; Beckman Institute

9:45–10:00 a.m. - Break

10:00–11:15 a.m. - Session 2

2.01 NCSA and the Illinois Learning Sciences Design Laboratory
Allen, Gabrielle; gdallen@illinois.edu; National Center for Supercomputing Applications

2.02 Teaching Students to Coordinate Scientific Text and Diagrams
Cromley, Jennifer; jcromley@illinois.edu; Educational Psychology; College of Education

2.03 Interactive Simulation Software as a Tool for Problem-Based Learning Approaches in Epidemiology
Johnson-Walker, Yvette; yjjohn38@illinois.edu; Clinical Epidemiology; College of Veterinary Medicine
Oliver, Nancy; noliver@illinois.edu; Design Group @ Vet Med; College of Veterinary Medicine
Shipley, Clifford F.; cshipley@illinois.edu; Veterinary Clinical Medicine; College of Veterinary Medicine

2.04 Understanding the Cognitive and Neural Mechanisms of Numeracy in Preschool Children through PC-based Training Studies
Berteletti, Ilaria; ilaria.berteletti@gmail.com; Developmental Psychology; College of Liberal Arts and Sciences
Hyde, Daniel C.; dchyde@illinois.edu; Psychology; College of Liberal Arts and Sciences
Mu, Yi; yimu2@illinois.edu; Psychology; College of Liberal Arts and Sciences
Simon, Charline E.; cesimon@illinois.edu; Psychology; College of Liberal Arts and Sciences

2.05 Enabling Students through a Modern, Computing-Centric Education
Fagen, Wade; waf@illinois.edu; Computer Science; College of Engineering
Heeren, Cinda; c-heeren@illinois.edu; Computer Science; College of Engineering

2.06 Enrichment Effects on Cognitive Skills
Stine-Morrow, Elizabeth A L; eals@illinois.edu; Educational Psychology; College of Education and Beckman Institute

2.07 Assessing Teaming Skills and Major Identity through Collaborative Sophomore Design Projects Across Disciplines
Amos, Jennifer; jamos@illinois.edu; Bioengineering; College of Engineering
Imoukhuede, Princes; spii@illinois.edu; Bioengineering; College of Engineering
Vogel, Troy; tvogel@illinois.edu; Chemical and Bimolecular Engineering; College of Liberal Arts and Sciences

2.08 RELATE: Create, Learn and Teach on the Web
Kloeckner, Andreas; andreask@illinois.edu; Computer Science; College of Engineering

2.09 Enhancing Student Skills in Synthesis and Creativity in the Classroom and Online
Hurley, Walter; wlhurley@illinois.edu; Animal Sciences; College of Agricultural, Consumer and Environmental Science
Allen, Crystal; callen@illinois.edu; Animal Sciences; College of Agricultural, Consumer and Enviromental Science

2.10 Successful Development and Execution of Planetary-Scale Illinois Courses: 143,000 Novices, No Prior Content
Angrave, Lawrence; angrave@illinois.edu; Computer Science; College of Engineering

2.11 The iTrain Project: Effects of Home-Based Verbal Working Memory Training on Language Comprehension in Older Adults
Payne, Brennan; payne12@illinois.edu; Psychology; College of Liberal Arts and Sciences and Beckman Institute
Stine-Morrow, Elizabeth; eals@illinois.edu; Educational Psychology; College of Education and Beckman Institute

2.12 Smart Grid Cyber Security: Training for the Future
Yardley, Tim; yardley@illinois.edu; Information Trust Institute; College of Engineering

2.13 Workplace Learning and Self in the Context of Late Modernity
Kuchinke, Peter; kuchinke@uiuc.edu; Education Policy, Organization and Leadership; College of Education

2.14 Bringing Simulation and Visualization Technology into the 21st Century Biology Classroom
Tajkhorshid, Emad; emad@life.illinois.edu; Biochemistry, and Center for Biophysics and Computational Biology; Beckman Institute
Ravaioli, Umberto; ravaioli@illinois.edu; Electrical and Computer Engineering; College of Engineering
Bellini, Michel; bellini@illinois.edu; Center for Innovation in Teaching and Learning

2.15 Fitness Effects on Whole Brain Functional Connectivity
Talukdar, Tanveer; ttanveer@illinois.edu; Beckman Institute

2.16 Metaphor Learning: An Instructional Tool that Builds New Knowledge by Leveraging Connections to a Learner's Existing Knowledge
Elliott-Litchfield, J. Bruce; b-litch@illinois.edu; Agricultural and Biological Engineering; College of Engineering
Hahn, Laura D.; lhahn@illinois.edu; Academy for Excellence in Engineering Education; College of Engineering

2.17 Illinois WIDER - Scaling Cultures of Collaboration: Evidence-based Reform in Gateway STEM Courses
Herman, Geoffrey; glherman@illinois.edu; Illinois Foundry for Innovation in Engineering Education and Curriculum and Instruction; College of Engineering/College of Education
Mestre, Jose; mestre@illinois.edu; Physics and Educational Psychology; College of Engineering and College of Education
Greene, Jennifer; jcgreene@illinois.edu; Educational Psychology; College of Education
West, Matthew; mwest@illinois.edu; Mechanical Science and Engineering; College of Engineering
Mena, Irene; imena@illinois.edu; Physics; College of Engineering
Tomkin, Jonathan; tomkin@illinois.edu; School of Earth, Society, and Environment, College of Liberal Arts & Sciences

2.18 Quantitative Correlation between Student Use of Office Hours and Course Performance
Heeren, Cinda; c-heeren@illinois.edu; Computer Science; College of Engineering
Fagen, Wade; waf@illinois.edu; Computer Science, College of Engineering

2.19 Development of an Interactive Three-Dimensional Model for Teaching Veterinary Anatomy
McCoy, Annette; mccoya@illinois.edu; Veterinary Clinical Medicine; College of Veterinary Medicine
Sinn-Hanlon, Janet M; j-sinn@illinois.edu; The Design Group @ Vet Med; College of Veterinary Medicine
Helms, Kerry; khelms@illinois.edu; Design Group @ Vet Med; College of Veterinary Medicine

2.20 Learning Design for Dual-Mode Courses
Burbules, Nick; burbules@illinois.edu; Education Policy, Organization and Leadership; College of Education
Lesht, Faye; flesht@illinois.edu; Center for Innovation in Teaching and Learning

2.21 Building a Community of Global Health Scholars
Amos, Jennifer; jamos@illinois.edu; Bioengineering; College of Engineering
Long, Kenny; long6@illinois.edu; School of Medicine and Bioengineering; College of Engineering
Miller, Gay; gymiller@illinois.edu; Pathobiology; College of Veterinary Medicine
Johnson-Walker, Yvette; yjjohn38@illinois.edu; Clinical Epidemiology; College of Veterinary Medicine

2.22 The Improve-To-Stay (ITS) Schedule for Learning: A Subject-Adaptive Regimen for Scheduling Practice
Fiechter, Joshua; fiechte2@illinois.edu; Psychology; College of Liberal Arts and Sciences
Benjamin, Aaron S.; asbenjam@illinois.edu; Psychology; College of Liberal Arts and Sciences

2.23 A Web-Based Course in Scientific Reasoning
Hubler, Alfred; hubler.alfred@gmail.com; Physics; College of Engineering

2.24 Exploring Learners' Argumentation and Cognitive Engagement in Online Discussions
Oh, Eunjung Grace; egraceoh@illinois.edu; Education Policy, Organization and Leadership; College of Education
Kim, Hyun Song; hyunsong.kim@gcsu.edu; Professional Learning and Innovation; Georgia College and State University

2.25 Crowdsourced Lecture Transcription
Ren, Jia Chen; jren4@illinois.edu; Computer Science; College of Engineering
Hasegawa-Johnson, Mark Allan; jhasegaw@illinois.edu; Electrical and Computer Engineering; College of Engineering
Angrave, Lawrence; angrave@illinois.edu; Computer Science; College of Engineering

2.26 The Child Development Laboratory: Bridging Theory, Research and Practice

Fisher, Meghan; mfisher2@illinois.edu; Human and Community Development; College of Agricultural, Consumer and Environmental Sciences
McBride, Brent; brentmcb@illinois.edu; Human and Community Development; College of Agricultural, Consumer and Environmental Sciences

2.27 Computerized Testing: A Vision and Initial Experiences

Zilles, Craig; zilles@illinois.edu; Computer Science; College of Engineering
West, Matthew; mwest@illinois.edu; Mechanical Science and Engineering; College of Engineering
Fagen, Wade; waf@illinois.edu; Computer Science; College of Engineering
Deloatch, Robert; deloatc2@illinois.edu; Computer Science; College of Engineering
Heeren, Cinda; c-heeren@illinois.edu; Computer Science; College of Engineering

2.28 The Impact of Semantic Retrieval on Previous and Future Learning

Divis, Kristin; divis1@illinois.edu; Psychology; College of Liberal Arts and Sciences
Benjamin, Aaron S.; asbenjam@illinois.edu; Psychology; College of Liberal Arts and Sciences

2.29 Exploring Student-Centered Approaches to Improve Participation of Underserved Learners in MOOCs

Bhat, Suma; spbhat2@illinois.edu; Beckman Institute
Perry, Michelle; mperry@illinois.edu; Educational Psychology; College of Education

2.30 Challenge-Inspired Undergraduate Education

Bhargava, Rohit; rxb@illinois.edu; Bioengineering; College of Engineering
Pool, Marcia; mpool@illinois.edu; Bioengineering; College of Engineering
Pan, Dipanjan; dipanjan@illinois.edu; Bioengineering; College of Engineering
Smith, Andrew M.; smi@illinois.edu; Bioengineering; College of Engineering
Carney, P. Scott; carney@illinois.edu; Electrical and Computer Engineering; College of Engineering

11:15 a.m.–noon - Session 3

3.01 An Educational Gaming Platform for Training Spatial Skills

Fu, Wai-Tat; wfu@illinois.edu; Computer Science; College of Engineering
Lane, Chad; hclane@illinois.edu; Educational Psychology; College of Education
Israel, Maya; misrael@illinois.edu; Special Education; College of Education

3.02 Using Computer-Adaptive Testing to Improve STEM Learning, Test Performance and Retention

Mestre, Jose; mestre@illinois.edu; Physics and Educational Psychology; Colleges of Engineering and Education
Anderson, Carolyn; cja@illinois.edu; Educational Psychology; College of Education
Chang, Hua-Hua; hhchang@illinois.edu; Educational Psychology; College of Education
Fabry, Gregory; glfabry2@illinois.edu; Electrical & Computer Engineering, College of Engineering
Gladding, Gary; geg@illinois.edu; Physics; College of Engineering
Kang, Hyeon-Ah; hkang31@illinois.edu; Educational Psychology; College of Education
Morphew, Jason; jmorphe2@illinois.edu; Educational Psychology, College of Education
Ryan, Katherine; k-ryan6@illinois.edu; Educational Psychology; College of Education

3.03 Enhancing and Understanding Learning and Memory through Multimodal Training

Paul, Erick; ejpaul@illinois.edu; Beckman Institute
Larsen, Ryan; larsen@illinois.edu; Beckman Institute
Barbey, Aron; barbey@illinois.edu; Speech and Hearing Science and Beckman Institute

3.04 Towards Scalability, Privacy, and Reliability in Peer Grading

Varshney, Lav; varshney@illinois.edu; Electrical and Computer Engineering; College of Engineering

3.05 Promoting Meaningful Participation in Online Learning Environments: Using Learner Analytics to Create Effective Feedback

Li, Jessica; jli2011@illinois.edu; Education Policy, Organization and Leadership; College of Education
Bell, Allison; amb@illinois.edu; Education Policy, Organization, and Leadership; College of Education
Hrubec, Debbie; hrubec1@illinois.edu; Education Policy, Organization, and Leadership; College of Education
Yang, Xue; yangxue81@gmail.com; Education Policy, Organization, and Leadership; College of Education
Lee, Seohyun; slee472@illinois.edu; Education Policy, Organization, and Leadership; College of Education

3.06 Let's Perceive Together: Toward a New Generation of Large-scale Tools for the Understanding and Extraction of Emotions in Text

Girju, Roxana; girju@illinois.edu; Linguistics and Computer Science; College of Liberal Arts and Sciences and Beckman Institute

3.07 Collaborative Patient Portals: Leveraging Conversational Agents

Morrow, Dan; dgm@illinois.edu; Educational Psychology; College of Education
Hasegawa-Johnson, Mark; jhasegaw@illinois.edu; Electrical and Computer Engineering; College of Engineering
Azevedo, Renato; razeved2@illinois.edu; Educational Psychology; College of Education
Gu, Kuangxiao; kgu3@illinois.edu; Electrical and Computer Engineering; College of Engineering
Soberal, Daniel; dsobera2@illinois.edu; Electrical and Computer Engineering; College of Engineering
Huang, Thomas; t-huang1@illinois.edu; Electrical and Computer Engineering; College of Engineering

3.08 PrairieLearn: An Adaptive Online System for Mastery Learning

West, Matthew; mwest@illinois.edu; Mechanical Science and Engineering; College of Engineering
Zilles, Craig; zilles@illinois.edu; Computer Science; College of Engineering

12:00–1:00 p.m. - Lunch

1:00 –1:15 p.m. - Break

1:15–2:20 p.m. - Session 4

4.01 STEM Learning through Technology-Enabled Physicality

Lindgren, Robb; robblind@illinois.edu; Curriculum and Instruction; College of Education
Garnett, Guy; garnett@illinois.edu; Illinois Informatics Institute
Mestre, Jose; mestre@illinois.edu; Physics and Educational Psychology; College of Engineering and College of Education

4.02 Encouraging Innovation, Enhancing Research, and Facilitating Economic Development through the Transfer of Intellectual Property

Sowers, Svetlana; svsowers@illinois.edu; Office of Technology Management
Wille, Steve; stvwille@illinois.edu; Office of Technology Management
Nair, Nicole; nnair@illinois.edu; Office of Technology Management

4.03 Sketch Recognition Technologies for Creation, Learning, and Assessment

Peschel, Joshua; peschel@illinois.edu; Civil and Environmental Engineering; College of Engineering
Mercier, Emma; mercier@illinois.edu; Curriculum and Instruction, College of Education
Herman, Geoffrey; glherman@illinois.edu; Illinois Foundry for Innovation in Engineering Education; College of Engineering

4.04 Game-Based Virtual Internship Environments

Israel, Maya; misrael@illinois.edu; Special Education; College of Education
Abelson, John; abelson@illinois.edu; Materials Science and Engineering; College of Engineering
Singer, Clifford; csinger@illinois.edu; Nuclear, Plasma and Radiological Engineering; College of Engineering
Lane, H. Chad; hclane@illinois.edu; Educational Psychology; College of Education
Fu, Wai-Tat; wfu@illinois.edu; Computer Science; College of Engineering
Newell, Ty; tynewell@illinois.edu; Mechanical Science and Engineering; College of Engineering

4.05 Lowering the Cost of Playfulness: Unlocking the Potential of Mobile and Virtual, and Unrestricted Computational Environments

Angrave, Lawrence; angrave@illinois.edu; Computer Science; College of Engineering

4.06 Virtual Sprouts: Game-based, Intelligent Learning Technologies for Science Education and Behavior Change

Lane, H Chad; hclane@illinois.edu; Educational Psychology; College of Education
Spruitj-Metz, Donna; USC Keck School of Medicine
Gotsis, Marientina; USC School of Cinematic Arts
Ragusa, Gisele; USC Viterbi School of Engineering
Davis, Jaimie; UT-Austin School of Human Ecology

4.07 Learning Critical Thinking at Scale: Automated Assessment of Complex Assignments for MOOCs

Geigle, Chase; geigle1@illinois.edu; Computer Science; College of Engineering
Zhai, Chengxiang; czhai@illinois.edu; Computer Science; College of Engineering
Cope, William; billcope@illinois.edu; Education Policy, Organization and Leadership, College of Education
Ferguson, Duncan; dcf@illinois.edu; Comparative Biosciences; College of Veterinary Medicine

4.08 Learning with Text and Image: The Relationship of Text-Image Integration to Interest and Comprehension

Peterson, Matthew; mop@illinois.edu; School of Art and Design; College of Fine and Applied Arts

4.09 Improving Contexts for Learning from Science Simulations with Gestural Inputs and Adaptive Framing

Brown, David; debrown@illinois.edu; Curriculum and Instruction; College of Education
Lindgren, Robb; robblind@illinois.edu; Curriculum and Instruction; College of Education
Lane, H. Chad; hclane@illinois.edu; Educational Psychology; College of Education

4.10 Beyond PowerPoint: Mobile-first, Dynamic, Trackable Presentations in HTML5

Fagen, Wade; waf@illinois.edu; Computer Science; College of Engineering

4.11 CD-CAT--From Adaptive Testing to Adaptive Learning

Chang, Hua-Hua; hhchang@illinois.edu; Educational Psychology; College of Education

4.12 The Art of Scientific Visualization for Learning and Outreach

Cox, Donna; donnacox@illinois.edu; National Center for Supercomputing Applications
Patterson, Robert; robertp@illinois.edu; Advanced Visualization Lab; National Center for Supercomputing Applications
Levy, Stuart; salevy@illinois.edu; Advanced Visualization Lab; National Center for Supercomputing Applications
Christensen, AJ; achrist3@ncsa.illinois.edu; Advanced Visualization Lab; National Center for Supercomputing Applications
Carpenter, Jeff; jeffc@ncsa.illinois.edu; Advanced Visualization Lab; National Center for Supercomputing Applications
Borkiewicz, Kalina; kalina@ncsa.illinois.edu; Advanced Visualization Lab; National Center for Supercomputing Applications

2:20–2:30 p.m. - Closing Remarks–Next Steps

Session I–Lightning Talks Abstracts

1.01 Can a Robot Learn Language as a Child Does?

Stephen Levinson, Electrical and Computer Engineering, Beckman Institute

If, instead of trying to program machines to behave intelligently, we design them to learn by experiencing the real world in the same way a child does, we might solve the speech recognition problem in the process. This is the ambitious goal of the research now being conducted in my laboratory. Our latest experiments are being conducted with a fully anthropomorphic robot and we expect to use its sophisticated sensori-motor function to greatly advance automatic language acquisition. This paper gives a brief retrospective of a research project begun in 1987 and continuing to the present on the topic of language acquisition by an autonomous humanoid robot. We recount the motivations for, theoretical bases of and experimental results on this subject. Important results include novel models and algorithms resulting in interesting linguistic function of our robots.

1.02 Computational Metacognition

Michael Twidale, Graduate School of Library and Information Science

As computational resources become ever more abundant, we see changes in the way people learn how to use, tinker, tailor, adopt, combine and modify them. Such activities are not restricted to the Computational Elites â€" we see elders exploring genealogy databases and families coordinating inter-generational interactions of video calling, photo-sharing and holiday planning. Tech learning is often a social activity, synchronous and asynchronous, co-located and remote, with colleagues and strangers. There won't ever be enough time or resources to teach everyone every application they will use. So instead can we teach computational metacognition - the skills of how to teach yourself a new technology? Some people seem to be really good at learning new technologies â€" and some aren't. Is there really a tech gene? Isn't it more likely that the people who are good at tech learning have acquired a set of skills â€" and that the people who aren't so good lack some of them? Are there certain misconceptions about computers and how to use them that prevent productive, efficient learning? Much focus is on helping children learn new technologies and use new technologies to learn. That is all noble and good. But what about the non-techie grownups? Should we be investigating how to help them? Or is our plan to wait for them all to die off? It is now rare to use a single program to do a task; we often have several open at once, copying and pasting data across. This allows for new kinds of innovation. Cobbling together Twitter, Google Docs, email, a database and a few web apps to get your job done better does not make you a Steve Jobs, but imagine what could happen to our economy and society if tens of millions of people started doing more playful learning for innovation.

1.03 Cloud Sharing of IOLab Data to Enable Collaborative Online Labs

Mats Selen, Physics, College of Engineering
Tim Stelzer, Physics, College of Engineering

We have developed an inexpensive battery-powered wireless laboratory system that allows students to do hands-on physics activities outside the classroom, using their own computer. The system, called IOLab, combines flexible software with a wireless data acquisition platform containing an array of sensors to sample and display real-time measurements of position, velocity, acceleration, force, rotation rate, orientation, magnetic fields, voltages, light intensity, sound intensity, pressure, and temperature. While ideal as a stand-alone lab tool, the educational potential of this system could be greatly enhanced if there were a simple mechanism for students to share both raw and analyzed data with each other, and with their instructor, in real time. As an example, each of the thousand or so students taking introductory E&M (Physics 212) at UIUC each semester might be asked to make measurements of the light intensity at various distances from the desk lamp in their dorm room, and to share these data with their professor prior to lecture. Their professor can then use these data in class as basis for a discussion of the inverse square law, using variations in student results to illustrate systematic errors. As a second example, students in hundreds of different middle-school classrooms across Illinois might be asked to measure the changes in outside temperature and atmospheric pressure over a one week period, allowing them to collaborate on state-wide a weather tracking project. In this project we will develop a web API, server application, and database that will interface to the existing IOLab system to enable real-time cloud data storage, sharing, and visualization.

1.04 Movement Influences Emotional Responses to Stimuli Viewed On Mobile Phones

Kevin Wise, Advertising, College of Media
Yilin Ren, Advertising, College of Media
Zongyuan (Glenn) Wang, Advertising; College of Media
Zheng, Anlan; azheng6@illinois.edu; Advertising; College of Media

Mobile devices allow people to acquire and engage with mediated content while moving. Research from an embodied cognition perspective suggests that physical cues may activate psychological concepts that, in turn, influence the subjective evaluations of stimuli. We believe that this perspective can inform our understanding of how movement affects the subjective emotional responses that are elicited by content received via mobile device. We have recently completed some exploratory research in which people evaluated a variety of pictorial stimuli on their mobile phones while both walking and standing still on a treadmill. Initial results suggest systematic response differences as a function of movement. Our theoretical premise is that using a mobile device while walking involves the experience of movement towards some destination. This may activate an approach mindset, which in turn will result in more favorable evaluations of stimuli acquired while walking. We have recently conducted an experiment in which participants view and evaluate images on a mobile phone while either walking or standing still on a treadmill. Preliminary results suggest that participants rated ambiguous Chinese ideographs as more pleasant when they were walking than when they were standing still. On the other hand, emotional pictures viewed while walking were perceived as more pleasant than pictures viewed while standing still. Furthermore, walking (relative to standing) appears to enhance the perceived difference between arousing and boring pictures, but diminish the perceived difference between arousing and boring pictures, but diminish the perceived difference between pleasant and unpleasant pictures. The role of mobility in users' cognitive and emotional responses to media has significant ramifications for the understanding of how to optimize mobile media for learning outcomes. We look forward to presenting our approach and fostering collaboration with others that have similar interests.

1.05 Big Data Comes to School: Reconceptualizing Evidence and Research in the Era of Technology-mediated Learning

William Cope, Education Policy, Organization and Leadership, College of Education
Mary Kalantzis, Curriculum and Instruction, College of Education

Over the past century, the learning sciences have come to be defined by an array of experimental, survey and ethnographic methods. Recent literature on big data, however, suggests new possibilities for educational evidence and research in the era of digitally-mediated learning by vritue of the large amounts of data, which are collected incidental to learning. In this presentation, we set out to explore the consequences of big data for educational research practice. The presentation includes theoretical and practical perspectives. Theoretically, we argue that a new generation of educational data sciences might require a reconceptualization of the nature of evidence of learning and the dimensions of our research practices. Practically, we will demonstrate some of the work we have been undertaking in the Scholar Project, funded by IES and the Bill and Melinda Gates Foundation.

1.06 Team Learning through Networked Communication and Game Actions

Alex Yahja; Institute for Computing in the Humanities, Arts, and Social Sciences; National Center for Supercomputing Applications
Andrew Pilny, Communication, College of Liberal Arts and Sciences
Marshall Scott Poole, Communication, College of Liberal Arts and Sciences

Most of learning and education has focused on individual learning with individual performance measures, rather than team learning with team performance measures. This talk describes the learning phenomena and processes that occur at the team and multiple-team levels when the teams are tasked to complete a team mission on VBS https://bisimulations.com serious game which emulates 3D spatial and physical environment for mission training. In other words, here we view learning as emergent phenomena arising from group or team communications and collective actions based on the Theories of Communication Networks. For the team learning investigation, we implemented an experimental scenario in which four teams in four vehicles, starting from different locations, have a mission of maneuvering to arrive at a rendezvous point while engaging opponents and defusing explosives. The teams are given mixed quality intelligence and intervention, which can be in the form of good, erroneous, and misleading information. In the experiments, we observed the learning curve interactions among team members and the networked communication patterns leading to team learning. We used Relational Event Modeling to analyze networked communication patterns and the results show correlations between communication patterns, learning processes, network structures, and team performance. This work is part of the larger effort to the grand challenge of scientifically understanding team learning from the teamwork and collaboration perspective. The Serious Game environment, the gameplay video capture and annotation, and the gameplay networked communication analyzer are tools to provide adaptive, visual, and detailed team feedback environment rather than simply individual feedbacks or uniform learning environments. As we gather more audiovisual data from team experiments, we are scaling up the tools to handle a large amount of data. Our team learning effort is part of an ongoing research on Network Science http://www.ns-cta.org funded by Army Research Lab.

1.07 Classrooms as Device Ecologies: Designing Technology to Support Collaborative Learning in Classrooms

Emma Mercier, Curriculum and Instruction, College of Education

Although an ever-increasing range of technology designed to support student learning is being used in classrooms, less attention has been paid to the integration of these devices and tools, and the potential to create tools for teachers to manage and learn from the technology. This lack of integration not only limits the effectiveness of the tools, but also means that the tools remain stand-alone features of the classroom, used only for special events, in contrast to the seamless integration of technology in our lives outside of classrooms and schools. The opportunity to develop tools that allow teachers to adapt their teaching in response to student actions, behavior and learning progress has also not been sufficiently explored. A network of devices in classrooms allows for the mining of student-created data to inform teachers of moment-to-moment changes in the students' progress, or to take a longer-term view of the learning arc across the duration of a curriculum. Drawing on a multi-year study of a technology enhanced classroom to support collaborative learning, I proposed the need to consider the teams, teacher, technology and tasks, when designing technology tools to support learning in classrooms. By taking this approach, technology development can no longer be considered solely in terms of how it serves the individual learner. The tools become integrated into the classroom device ecology, and the role of the teacher becomes more integrated into the learners' experiences with technology.

1.08 Utilizing Tools from Network Science and Machine Learning to Understand the Structure and Malleability of Brain Networks

Aki Nikolaidis, Beckman Institute
Drew Goatz, Bioengineering; College of Engineering
Paris Smaragdis, Computer Science; College of Engineering
Arthur Kramer, Beckman Institute

Recently, the field of neuroscience has embraced more computationally rigorous approaches to exploring, visualizing, and analyzing data. Two fields of particular interest in this domain are network science, which uses abstract representations from graph theory to characterize emergent network properties, and machine learning, which uses computational techniques from statistical learning theory to create models and make predictions on unseen data. Separately, these two fields have become more common in the analysis of MRI data; however, these two realms of analysis are highly complementary in their goals and perspectives. We propose a framework that combines these two fields to understand how the structure of these networks relate to learning and cognitive performance, and we discuss some preliminary results. The main tools of our framework fall into four categories: 1) Use functional MRI to create networks of interest using different edge metrics; 2) Assess graph theoretic properties of these networks; 3) Feed these graph theoretic metrics into machine learning algorithms to predict cognitive ability, learning in response to training, and other traits; 4) Utilize visualization tools to aid in interpretation of results and guidance of future hypotheses. The goal of this research is to create new insights in the relationship between brain plasticity and learning that will allow researchers and educators to develop more effective tools for education and cognitive enhancement.

Session II–Interactive Posters, Round Tables, and Demonstration Abstracts

2.01 NCSA and the Illinois Learning Sciences Design Laboratory

Gabrielle Allen, National Center for Supercomputing Applications

The National Center for Supercomputing Applications (NCSA) is following a strategy to become a unique center for research, education, and innovation in an advanced digital age. It will become a home for addressing complex research problems in science and society, powered by the development and application of advanced and comprehensive digital environments. To this end, NCSA is establishing faculty-led thematic areas that will join faculty, students, postdocs and research staff in addressing interdisciplinary grand challenge problems going beyond traditional department efforts. Initial themes are in physics and astronomy, earth and environment, computing and data sciences, bioinformatics and health sciences, materials and manufacturing, as well as culture and society. Enabling new methodologies of student learning and training, and engaging students in interdisciplinary research is an important component of NCSA's vision. This lightning talk will describe NCSA programs and facilities that could contribute towards a learning sciences design laboratory.

2.02 Teaching Students to Coordinate Scientific Text and Diagrams

Jennifer Cromley, Educational Psychology, College of Education

Students at the middle school through undergraduate level are presented with about 1 image/page of science text. A critical task is to connect written text with photographs, drawings, tables, and combinations of these. We created two workbook-and-discussion-based interventions for high school biology to help students learn how to coordinate text and diagrams: a basic introduction to Conventions of Diagrams (COD; e.g., uses of color, meanings of arrows) and a more complex Coordinating Text and Diagrams (CTD; e.g., draw a line from the figure reference to the figure) condition. Teachers were trained and delivered the interventions to 158 high-school students, who had been pretested on biology (near transfer) and geology (far transfer) knowledge and diagram comprehension, as well as spatial skills. All students were posttested on knowledge and diagram comprehension, and workbook responses were coded for depth of cognitive engagement. Both groups showed significant growth in biology diagram comprehension ($d = .28$ to $.57$), and in biology knowledge ($d = .30$ to $.53$). However, for far transfer, only the CTD group in School 2 showed significant gains ($d = .41$). Analyses of student work products suggest that greater engagement with instruction was associated with more gain from the interventions, and there were effects of both condition and school on engagement. Students with high spatial skills were advantaged in the COD condition on the geology (far transfer) posttest; students with low spatial skills were disadvantaged. Results suggest that students can be taught to coordinate text and diagrams with concurrent gains in scientific knowledge, that direct instruction in CTD yields larger effects which compensates for low spatial skills, and far transfer to an uninstructed domain can sometimes be obtained. These promising methods should be tested with other domains and at other educational levels to determine whether the results generalize.

2.03 Interactive Simulation Software as a Tool for Problem-Based Learning Approaches in Epidemiology

Yvette Johnson-Walker, Clinical Epidemiology, College of Veterinary Medicine
Nancy Oliver, Design Group @ Vet Med, College of Veterinary Medicine
Clifford F. Shipley, Veterinary Clinical Medicine, College of Veterinary Medicine

Epidemiology is the study of disease dynamics within populations. A basic understanding of epidemiology is essential for evidence-based clinical decision-making and critical assessment of scientific literature. Despite its importance, recent studies have documented that medical and veterinary students often express a lack of interest in the subject or fail to perceive its relevance to clinical practice. Problem-based learning has been demonstrated to enhance students' grasp of epidemiologic principles, enthusiasm about the subject matter and understanding of its professional relevance. However, increasing class size and decreased student contact time presents even greater challenges to faculty now tasked with teaching epidemiology in a problem-based format. One promising approach to this issue has been applied at the University of Illinois College of Veterinary Medicine. Adobe Captivate Simulation Software is been applied to several disease outbreak simulations for students in the DVM professional curriculum. Students receive a case history for a potential disease outbreak prior to the class meeting. Prior to class, students work independently to confirm the outbreak, establish differential diagnoses, and decide on diagnostic tests. During the in-class session students work in groups to interpret diagnostic test results and assess the farm premises. By the end of the 2-hour session students have determined the etiology of the outbreak, assessed its economic impact on the producer and developed control strategies to prevent future outbreaks. This approach allows students to think critically about data received from the farm owner, clinical observations of the affected and unaffected animals, production records, and diagnostic test results in a real-world scenario. Statistical analysis of risk factor data permits development of data-driven control and prevention strategies with consideration of the economic impact to producers. New simulations are under development that focuses on foodborne disease outbreak investigations.

2.04 Understanding the Cognitive and Neural Mechanisms of Numeracy in Preschool Children through PC-based Training Studies

Ilaria Berteletti, Developmental Psychology, College of Liberal Arts and Sciences
Daniel C. Hyde, Psychology, College of Liberal Arts and Sciences
Yi Mu, Psychology, College of Liberal Arts and Sciences
Charline E. Simon, Psychology, College of Liberal Arts and Sciences

Numerical competency when entering school is one of the strongest predictors of later achievement in mathematics and science (Duncan et al., 2007). Past work has identified several candidate mechanisms children may use and/or combine to move from primitive, non-symbolic intuitions about number and mathematics to formal exact, symbolic number concepts (e.g., Carey, 2009; Spelke & Kinzler, 2007; Frank, in press; Piazza, 2010). These mechanisms fall into three categories: non-linguistic numerical systems, visual-spatial matching routines, and linguistic systems. Despite the identification of each of these cognitive abilities and suggestive evidence for a role in the development of numeracy, the contribution of each remains an open question. Our ongoing project aims are to identify the cognitive and neural mechanisms by which early numerical learning occurs and to use this knowledge to improve numerical skills in children before entering school. To do this, we are currently testing the role of each of these hypothesized cognitive mechanisms in the development of numeracy through randomized, short-term, intensive, PC-based training interventions with preschoolers. In this brief presentation, we will discuss our preliminary results suggesting that 1) Participating in our computer training games for two weeks leads to conceptual gains that otherwise take at least several months for children to achieve, 2) differences in the effectiveness of each type of game reveal insights into the basic cognitive and brain mechanisms driving conceptual development, with some hypothesized mechanism playing more important roles than others, and 3) the development of symbolic number concepts is associated with qualitative changes in the brain. In addition, we will discuss further plans to implement our number training computer games in local preschools, to measure their effectiveness in a real classroom setting.

2.05 Enabling Students through a Modern, Computing-Centric Education

Wade Fagen, Computer Science, College of Engineering
Cinda Heeren, Computer Science, College of Engineering

For a student looking for their first job, it has been a long time since knowing Word, Excel, or PowerPoint would be something that gets them ahead. However, many colleges and universities continue to teach basic computer literacy to students who have used computers their entire life. Inside Computer Science, we are working to develop a means to achieve a modern, computing-centric education through the use not of computer literacy but computing skills. Toward that end, a two course sequence was developed that provides a computing-centric model for students to utilize computing within whatever discipline they have chosen. The first course, 'CS 105: Computing Fundamentals', serves as an introduction to JavaScript, computational Excel, and data visualization; the second course, 'CS 205: Data Driven Discovery', expands on their programming with Python, more visualization, and place all their work in a growing 'computing portfolio' that displays their technical skills as a non-technical major. In both courses, students are exposed to programming on the very first day. Nearly all of the assignments are data-centric; many where students come to the assignment with their own data and learn how to convert, analyze, and visualize their data in ways that are not possible using only Excel or PowerPoint. By the end of one semester, students can create data visualizations similar to that of visualizations in New York Times articles. By the end of the two semesters, students will have a portfolio of nearly thirty programs that analyze data in different ways. This talk will explore how a computing-centric approach towards education for non-technical majors provides significant value to their degree and how deeper educational experiences can be done in future classes when students come into a classroom with computing literacy.

2.06 Enrichment Effects on Cognitive Skills

Elizabeth A L Stine-Morrow, Educational Psychology, College of Education and Beckman Institute

While it is clear that crystallized abilities and knowledge grow through experience, the principles governing growth in fluid abilities, or mental mechanics are not well understood. The plasticity of cognitive skills, such as speed of processing, working memory, and inductive reasoning, is great interest with respect to early life development because of the potential to improve academic performance (Finn et al., 2014), and with respect to adult development because of the potential to expand the period of cognitive health into late life (Hertzog, Kramer, Wilson, & Lindenberger, 2008). Such interests have spawned a growing industry in brain training, based on the assumption that mental exercise has broad-based effects on mind and brain. We tested this assumption in the Senior Odyssey project (Stine-Morrow et al., 2014) in which older adult participants were randomly assigned to (a) a multimodal team-based program of creative problem solving, (b) ability-specific training in inductive reasoning, or a (c) waitlist control. Contrary to the idea that mental effort evokes broad effects on mental capacities, both the creative problem solving and the reasoning groups showed highly specific effects of enrichment. Our research lends support to the idea that cognition is highly plastic into late life, but also suggests that broad enrichment of cognitive skills will depend on rich educational experiences that explicitly target skills for growth.

2.07 Assessing Teaming Skills and Major Identity Through Collaborative Sophomore Design Projects Across Disciplines

Jennifer Amos, Bioengineering, College of Engineering
Princes Imoukhuede, Bioengineering, College of Engineering
Troy Vogel, Chemical and Bimolecular Engineering, College of Liberal Arts and Sciences

Engineering curricula have been focused on integrating design in the freshman and senior years but often fail to integrate projects into the crucial sophomore and junior years. The study consists of one section of bioengineering students paired with one section of chemical engineering students. The project consists of an exploration of energy balance in the body revolving around economic resources available to meet nutritional needs. Bioengineering students initially lead the project and act as data gatherers and frame the nutritional/biology needs and absorption models. During this phase, students explore the grocery store to gather nutritional content, and submit a plan for a day-long menu with constraints of varying budgets, $5, $10, and unlimited, to meet nutritional caloric intake for an individual. The chemical engineering teams then lead the optimization using multiple design scenarios to, such as increasing caloric intake for nursing mothers, reducing for dieting, or excluding food items for allergy. Preliminary findings show that each program of students genuinely brings different skills and emphases to the project. We find that students on interdisciplinary teams have higher performance in working within real-world constraints, make recommendations to include social and economic concerns, interact within a team, and have an appreciation for other engineering disciplines. Presentation will provide results from the pilot relating to understanding of teaming skills and social context of engineering solutions.

2.08 RELATE: Create, Learn and Teach on the Web

Andreas Kloeckner, Computer Science, College of Engineering

RELATE aims at providing instructors with the opportunity to design engaging online experiences that interleave learning, practice, and evaluation. RELATE's basic unit of teaching is called a 'flow'. Flows may contain and freely intermix videos, multiple-choice quizzes, survey questions, free-text answers, instantaneously auto-graded code exercises (with sandboxed code execution) and more. All these elements are built into RELATE. But instructors (not just site administrators!) can optionally implement, from the code level up, any experience that enhances their course material. RELATE takes content creation and reusability seriously. Course content is created as text files in a reusable, standard format ('YAML') to allow efficient writing, with robust version control deeply integrated into the system. A course calendar, a gradebook, flexible grading (instantaneous automatic grading as well as deferred hand-grading), and a comprehensive rules system round out the package.

2.09 Enhancing Student Skills in Synthesis and Creativity in the Classroom and Online

Walter Hurley, Animal Sciences, College of Agricultural, Consumer and Environmental Science
Crystal Allen, Animal Sciences; College of Agricultural, Consumer and Enviromental Science

Engaging students in learning environments that foster inquiry, creativity, innovation, problem-solving, collaboration, and communication skills is a critical goal for preparing the students for their future. We teach several on-campus courses in which the learning environments include successful activities that promote many of those skills. For example, we use a Box Project activity in which groups of students are provided with a plain cardboard box and challenged to use the box as the primary medium for developing a report on their topic that is shared with the rest of the class. This project encourages students to learn about their topic and demonstrate their collective knowledge about their topic in a creative final product that is the platform for sharing their learning. Other learning activities include development of games in which each group of students uses their game to teach the other students about their project topic. We are interested in partnering with other instructors, researchers, and technical consultants in an effort to further enhance the learning value of these and other learning environments based on enhanced technology-based methods and current learning theory. This includes the possibility of adapting these learning environments to online venues, including MOOCs. Such collaboration will further stimulate the development of high impact activities that engage students in a range of professional competencies, as well as form the basis for further research on these types of learning environments.

2.10 Successful Development and Execution of Planetary-Scale Illinois Courses: 143,000 Novices, No Prior Content

Lawrence Angrave, Computer Science, College of Engineering

In December 2013 we introduced students with no prior programming or development experience, to the thrill of creating and sharing their own Android Apps. The success of this course, 'Creative, Serious and Playful Science of Android Apps,' can be directly attributed to modern approaches to learning and MOOC instructional methodologies and technologies. The latter includes peer-assessment, embedded video, dynamic and interactive web content, on-campus interviews of undergraduates and faculty, and active and inclusive discussion forums. The course content had no on-campus predecessor and was built entirely from new materials. Well-known pedagogical and psychological perspectives including Bloom's taxonomy and Robert Bjork's 'Forgetting as a Friend of Learning' were used to structure the cognitive pacing, affective content and evaluation points throughout the course. The course content was structured around weekly themes and a new app was created, debugged and tested each week. The last lecture slot of each week was used for less-technical content with affective and broader learning goals in mind. We used this time to introduce computer science and Illinois cultural and affective items. This was not merely an opportunity to share an institution's culture but an opportunity to change the course pace, reduce visual monotony and place students' current interests within larger field of computer science as a historical and contemporary, living field of endeavor. Peer assessment was used to grade student assignments, and students self reported that they were inspired by each stage of the peer-assessment. The main outcome of this MOOC is a successful introduction of Illinois and Android development to students the world over. Secondly, we conclude it is possible to construct a technically demanding yet accessible and engaging course and employ MOOC opportunities to lower the learning curve of advanced topics.

2.11 The iTrain Project: Effects of Home-Based Verbal Working Memory Training on Language Comprehension in Older Adults

Brennan Payne, Psychology, College of Liberal Arts and Sciences and Beckman Institute
Elizabeth Stine-Morrow, Educational Psychology, College of Education and Beckman Institute

Effective language understanding is crucial to maintaining cognitive abilities and learning new information through adulthood. However, age-related changes in cognitive abilities such as working memory have a profound influence on the products of language comprehension (e.g., problem solving, learning, following instructions). At the same time, the effects of age and working memory on the moment-to-moment processes underlying language comprehension (e.g., attentional allocation during reading) are less well understood. We introduce the iTrain project, which aims to test the causal role of working memory in language understanding in older adults by examining the effects of working memory training on processing and comprehension. The project has two aims. The first is to establish the efficacy of a novel home-based computerized cognitive training intervention targeting complex verbal working memory performance in older adults. The second goal is to investigate the downstream effects (i.e., transfer) of improved working memory on language processing and comprehension outcomes in older adults. Results from this study provide some of the first data regarding the effectiveness of short-term cognitive training interventions on language processing and performance in older adults. Findings are discussed in relation to current models of memory and language in the psycholinguistics and cognitive aging literature.

2.12 Smart Grid Cyber Security: Training for the Future

Tim Yardley, Information Trust Institute, College of Engineering

The intent of this activity is to develop an open training platform that facilitates the rapid education of a wide variety of participants on important aspects of smart grid cyber security. The training platform will consist of both presentations and hands-on training exercises that will aid in the education of interested parties in research, industry, and government. In this work, we aim to create a phased and modular learning platform that provides the essential base knowledge for this sector and builds upon that base knowledge with each lesson to advance students' understanding of smart grid cyber security. At each phase in the process, we will provide concrete applications of the topic areas to facilitate participants' learning. By using a combination of diverse educational strategies, we expect to be able to train a variety of people effectively and efficiently. This effort provides the basis for short courses, summer schools, and even masters curriculum that can be used openly throughout the world.

2.13 Workplace Learning and Self in the Context of Late Modernity

Peter Kuchinke, Education Policy, Organization and Leadership, College of Education

Workplace learning, defined as learning for, at, through, and about work (Copa, 1982) has increased in scope and importance over the past three decades, and now constitutes a learning enterprise that rivals public education in participation rates, expenditures, and impact on adults, organizations, communities, and nations. The undertaking has also sat uneasily with education scholars from the days of the corporation schools in the late 1800s to today's corporate 'universities' for its functional orientation, its performative focus, and managerial goals. While the range of workplace learning affordances is, indeed, vast, ranging from narrow skills training to action learning in the liberal arts tradition, neo-liberal assumptions of the learner, the outcomes of learning, and the processes during which learning unfolds dominate the field. As a result, this important area of educational practice tends to be under-theorized and suffers from impoverished practice, represented by poor rates of learning transfer, apathy among participants, and skepticism, even cynicism, towards the undertaking as a whole. The goal of this presentation is to outline the contours of a more robust and adequate theoretical foundation by connecting workplace learning to sociological analyses of the individual in late modernity, specifically the work of Giddens, Bauman, Foucault, and Deetz. Four relevant themes will be outlined: the possibility of enacting personhood in the age of corporate colonialization of the self; the rhetoric, promise and reality of learning in the context of commercial organizations; the distributed and social nature of learning in workplace settings; and, finally, the role of resistance to workplace learning initiatives.

2.14 Bringing Simulation and Visualization Technology into the 21st Century Biology Classroom

Emad Tajkhorshid, Biochemistry, and Center for Biophysics and Computational Biology, Beckman Institute
Umberto Ravaioli, Electrical and Computer Engineering, College of Engineering
Michel Bellini, Center for Innovation in Teaching and Learning

Advances in molecular sciences have revolutionized our understanding of molecular phenomena in disciplines ranging from nanotechnology to molecular biology and medicine. At the same time, they have created a formidable challenge to educators in these disciplines, by necessitating a significant amount of complex concepts and detailed descriptions to be added to the regular curriculum. Unique capabilities developed at Illinois can enable us to meet these challenges, and a joint effort between engineering and biology units on campus has been set out to modernize the teaching of biology by bringing interactive simulation and visualization technology into the classroom. Our goal is to infuse curricula with nanoscience concepts to appeal to both students in life sciences and engineering, with a suite of computational and visualization tools facilitating the development of qualitative and quantitative skills. The initial effort is to showcase examples of various molecular systems with important biological functions in which structural elements and dynamical events are packaged as classroom examples. Pre-calculated simulation results and visualization scenes will be created for interactive sessions. An example is expulsion of anti-cancer drugs by a membrane exporter protein through structural changes of the protein device induced by ATP. A catalog is planned of important molecular interactions and cellular mechanisms, which are at the basis of physiological function and biological sensing, and we will realize for each a companion simulation driving a molecular visualization module. Multiple environments, including advanced workstations but also handheld mobile devices and emerging low-cost virtual reality platforms will be considered to augment the pedagogical possibilities. For pervasive access of material, we will take exploit our expertise on Internet hub technologies (nanohub.org, HUB-zero) to deploy modules for online access, realizing a pervasive educational cyber infrastructure that could benefit other campus initiatives.

2.15 Fitness Effects on Whole Brain Functional Connectivity

Tanveer Talukdar, Beckman Institute

Over the last few decades, there has been major progress in examining and understanding the functional interactions between different brain regions in healthy and diseased brains. Functional neuroimaging with fMRI in particular has been extensively used for investigating the complex network of anatomically separated regions, which exhibit temporal dependence of neural activity patterns known as functional connectivity. More recently, functional connectivity analysis using resting state fMRI have revealed spatially distributed and functionally linked regions that form complex brain networks. Although, these studies can provide valuable insight into the organization and integration of different brain sub-systems based on whole brain functional connectivity profiles, they cannot be used to test for differences in connectivity patterns attributed to variability in phenotypic factors between groups or within individuals. In this presentation we introduce application of a novel method called multivariate matrix distance regression (MDMR) to investigate differences in whole brain connectivity profiles with respect to fitness measures based on individuals' maximum oxygen consumption (VO2 max). Based on the MDMR analysis, we found regions in the brain whose functional connectivity profiles vary significantly with inter-subject differences in VO2 max, which had been adjusted for age and gender ($p < 0.05$, $N = 187$).

2.16 Metaphor Learning: An Instructional Tool that Builds New Knowledge by Leveraging Connections to a Learner's Existing Knowledge

J. Bruce Elliott-Litchfield, Agricultural and Biological Engineering, College of Engineering
Laura D. Hahn, Academy for Excellence in Engineering Education, College of Engineering

Metaphors are powerful teaching tools. Metaphors, including allegories and parables, have been used through the ages for teaching and learning, particularly for subjects like values, ethics, and wisdom. Metaphors leverage existing scaffolds of knowledge to build new knowledge structures by comparing, extending, transferring, or carrying over a key concept from existing knowledge to the knowledge that is being learned (see etymology of metaphor: to carry over). Metaphor Learning is proposed as a concept for an instructional tool that will use the power of metaphors, eventually tailored to an individual's existing knowledge and preference. We envision a multi-step development that includes (1) find and develop metaphors to teach selected topics, (2) expand the archive of metaphors via an open-sourced, wiki-metaphor site, and (3) develop an individualization tool that catalogs what an individual knows and selects metaphors based on her/his past preferences. (Think of a Pandora music station that recommends songs based on one's past preferences.) Metaphor Learning will contain your current knowledge portfolio (playlist) and recommend learning/metaphor preferences based on past preferences. We are currently in the early conceptual stage, seeking expertise and collaborators.

2.17 Illinois WIDER - Scaling Cultures of Collaboration: Evidence-based Reform in Gateway STEM Courses

Geoffrey Herman, Illinois Foundry for Innovation in Engineering Education and Curriculum and Instruction, College of Engineering/College of Education
Jose Mestre, Physics and Educational Psychology; College of Engineering and College of Education
Jennifer Greene, Educational Psychology, College of Education
Matthew West, Mechanical Science and Engineering, College of Engineering
Irene Mena, Physics, College of Engineering
Tomkin, Jonathan; tomkin@illinois.edu; School of Earth, Society, and Environment, College of Liberal Arts & Sciences

We are transforming gateway Science, Technology, Engineering, and Mathematics (STEM) courses under the rallying message of teach like we do research. At Illinois, we have a vibrant, collaborative research culture that stimulates innovation and excellence. In contrast, we have a fiercely independent teaching culture that resists the adoption of Research-Based Instructional Strategies (RBIS); transmission-model lectures are normative and faculty often have sole jurisdiction of their courses. The current culture stifles faculty learning and impedes adoption of practices that can improve student learning. We are undertaking an effort to transform the teaching culture in gateway STEM courses through the creation of faculty Communities of Practice (CoPs) that organize faculty into collaborative, joint ownership of their courses. We organized faculty into course-focused CoPs, which integrate and sustain the use of RBIS into their courses. These course-focused CoPs are organized into an institution-level network of CoPs, which are overseen and supported by a central cross-college leadership team. Coming from the Colleges of Engineering, Liberal Arts and Sciences, and Education, the team is composed of faculty and faculty developers who have experience with RBIS and are invested in creating change. These members attend the weekly meetings of the course-focused CoPs to provide just-in-time training and cross-pollinate fruitful efforts. Critically, the CoP environment supports a teaching culture that aligns with our research culture, providing a structure that enables supports faculty learning and motivation. Faculty members work collaboratively to identify their next-steps in knowledge advancement or ability. They are provided with just-in-time guidance to identify literature and methods for collecting data to guide their course development. Accordingly, the leadership team provides just-in-time training as gaps in each CoP's knowledge were identified. Through these iterative implement-evaluate development cycles, it is expected that faculty will emergently adopt RBIS, improving instruction.

2.18 Quantitative Correlation between Student Use of Office Hours and Course Performance

Cinda Heeren, Computer Science, College of Engineering
Wade Fagen, Computer Science, College of Engineering

University courses with a significant computing component typically provide support for student learning in the form of open lab hours attended by instructional staff. Students visit the open lab to work on computer-based assignments, and staff address questions as they arise, thereby providing just-in-time instruction and removing barriers to student progress. We have developed an online queuing system that we use to schedule student assistance in many of our core computing courses. While electronic queuing systems have been used in computing labs for decades, our web tool is instrumented to record both a complete historical log of interaction times between students and staff, a coarse-grained feedback on student preparedness, for every interaction. The analysis presented in this talk is our attempt to understand who uses the open labs, and what benefit, if any, they receive by doing so. We have recorded data over three consecutive semesters in three large classes, charting approximately 14,000 staff-student interactions. In this talk we examine queue use patterns in the context of regular assignment due dates, and we correlate staff-student interactions with student scores on exams and on programming projects. Most notably, we find: (1) student use of the lab resources accelerates near due dates (surprise!), (2) student use of staffed lab hours follows the 80-20 rule where 80% of the staff time is spent answering questions from 20% of the students, and (3) the 20% of students who use office hours most frequently perform significantly better on programming assignments, but only marginally better on exams than the other students in the course. We continue to use the online queue system and we are using the results of the initial analysis to deploy staff more effectively and to adapt course policy to the reality of student study behaviors.

2.19 Development of an Interactive Three-Dimensional Model for Teaching Veterinary Anatomy

Annette McCoy, Veterinary Clinical Medicine, College of Veterinary Medicine
Janet M. Sinn-Hanlon, The Design Group @ Vet Med, College of Veterinary Medicine
Kerry Helms, Design Group @ Vet Med, College of Veterinary Medicine

Anatomy is unquestionably one of the fundamental disciplines of veterinary medicine. While cadaver dissection is widely used as a core component to teaching anatomy and is of tremendous value, this approach has its limitations. This is particularly true when attempting to instruct students in the anatomy of large animals, including horses, for which cadaveric specimens are more difficult to obtain and store. Additionally, dissection of many crucial structures, including those within the hoof capsule, is extraordinarily challenging, so current instruction techniques rely on cross-sectioned specimens, two-dimensional diagrams, and occasionally radiographs. Development of an alternative teaching tool for these anatomical structures would be invaluable in the education of our professional students, as well as be useful for client/public education and as a resource for referring veterinarians. Three-dimensional computer modeling based on high-resolution imaging (magnetic resonance imaging [MRI] and computed tomography [CT]) offers tremendous promise in the development of a detailed, interactive tool that would allow for virtual dissection of specimens. Initial development of this tool will leverage the imaging resources at the Biomedical Imaging Center (BIC) at the Beckman Institute and the software suites and graphic design expertise available within the Design Group at the College of Veterinary Medicine. After the initial model development, with its primary goal of enhancing the teaching of basic anatomy, there is tremendous potential for expansion of the scope of this project. For example, coupling the model with its parent data would create a novel training aid for interpretation of advanced imaging technologies. Further, interfacing with a virtual reality environment would open up applications for surgical training.

2.20 Learning Design for Dual-Mode Courses

Nick Burbules, Education Policy, Organization and Leadership, College of Education
Faye Lesht, Center for Innovation in Teaching and Learning

How can we best engage students in courses that include online and campus-based students in the same course at the same time? Referred to as dual-mode courses, this presentation will share insights based on Professor Burbules' experience teaching dual-mode courses as well as research being conducted by Dr. Lesht (and others) this term on the dual-mode course, Educational and Policy Studies (EPS) 410.

2.21 Building a Community of Global Health Scholars

Jennifer Amos, Bioengineering, College of Engineering
Kenny Long, School of Medicine and Bioengineering; College of Engineering
Gay Miller, Pathobiology; College of Veterinary Medicine
Yvette Johnson-Walker, Clinical Epidemiology, College of Veterinary Medicine

Students hear all the time that they need to work in interdisciplinary teams, but how often do they get to try it while in college? Collaboration and student projects that span departments are often seen as too difficult to pursue due to logistical or topical related barriers. This project demonstrates an approach at true interdisciplinary design projects within a sophomore level material/energy balance courses in both Bioengineering and Chemical Engineering programs. Today's students are tomorrow's global problem solvers. The issues they will face are astounding, including climate change, global population expansion, and the depletion of natural resources. Experiential learning is one of the most effective strategies to gain first-hand experience working in an international, interdisciplinary environment, acquiring the skills necessary to ensure their success. We propose to pilot the next step of this trend: the integration of experiential design and global learning with work on solutions of global problems. Over the past two years, a working group comprised of students and faculty from the Colleges of Engineering, Medicine, Applied

Health Sciences, ACES, Veterinary Medicine, Business, and LAS has developed the framework to connect prior disjointed efforts around the existing Illinois-Njala partnership. We introduce a campus-wide certificate program for global-health minded students. With support from on-campus funding sources, four new courses will debut in 2015-2016, and will serve as the backbone for a future global health scholars (GHS) certificate. The program begins with an interdisciplinary, introductory course focusing on understanding cultural differences, historical perspectives that encouraged the Illinois/Njala partnership, and the importance of addressing the needs of a community in a holistic manner that addresses human, animal and ecosystem health concerns. Students will then select from subject-specific courses: tropical epidemiology; food security in resource-limited settings; sustainable engineering practices and sustainable marketplaces. An interdisciplinary capstone design project will bring the overall theme of global health scholarship together. Each of these courses is being developed using a hybrid lecture/online module model for delivery at both Illinois and Njala via Moodle, developed with specific case studies derived from real-world experiences and problems present in Sierra Leone. The courses will also be available for non-degree seeking students. We see this as the beginning of bringing Global Health to the forefront of work done at Illinois.

2.22 The Improve-To-Stay (ITS) Schedule for Learning: A Subject-Adaptive Regimen for Scheduling Practice

Joshua Fiechter, Psychology, College of Liberal Arts and Sciences
Aaron S. Benjamin, Psychology, College of Liberal Arts and Sciences

The gold standard practice schedule for learning multiple related skills is random practice, which involves random interleaving of the to-be-acquired skills. However, there are reasons to believe that such a schedule may sometimes be too challenging at the beginning of learning, particularly for unskilled performers. The Improve-to-Stay (ITS) practice schedule, introduced here, is a subject-adaptive schedule that switches between tasks only when the subject fails to improve on past performance. The probability of switching between tasks thus follows a learning curve, resulting in increasingly randomized practice with experience. In a series of experiments, subjects learned to type three keyboard patterns, each with a unique goal typing time. Subjects practiced on either a random practice schedule, a blocked practice schedule, or an ITS schedule. The ITS schedule promoted retention as effectively as or even better than random practice. Furthermore, we replicated these findings in an additional experiment using a sentence-typing task. All told, these experiments provide evidence for a highly effective schedule that is applicable to a wide range of learner skillsets.

2.23 A Web-Based Course in Scientific Reasoning

Alfred Hubler, Physics, College of Engineering

Quantitative reasoning skills are a fundamental tool in many part of society, ranging from mathematics and science to engineering and from law and business to rhetoric. In Middle School and High School quantitative reasoning is almost never taught, except in the context of other disciplines, such as mathematics or physics. Recently a Middle School course in reasoning was developed and field-tested. The course introduces basic elements of reasoning, such as the definition of a concept and the definition of a strategy. The course concepts are applied to algebraic proofing. We find that a diverse population of female middle school students readily accepts this approach and achieves proofing skills on a level which is comparable to university freshmen.

2.24 Exploring Learners' Argumentation and Cognitive Engagement in Online Discussions

Eunjung Grace Oh, Education Policy, Organization and Leadership, College of Education
Hyun Song Kim, Professional Learning and Innovation, Georgia College and State University

The purpose of this session is to introduce preliminary findings of a study exploring how adult learners engage in asynchronous online discussions through implementation of a structured argumentation activity. The researchers designed structured audio-based online argumentation activities to promote students' cognitive engagement. The study was conducted in two online graduate courses at a small liberal arts university. Research questions are two fold: 1) how is learner argumentation discourse characterized in audio-based asynchronous discussion activities; 2) how do learners engage in text-based and audio-based asynchronous discussion activities? Primary data sources were learners' text-based postings from weekly discussions, audio recordings from weekly audio-based scaffolded argumentation activities, and semi-structured interviews. Discussion postings were analyzed at the meaning (components of argumentation), message (levels of thinking), and episode levels (overall quality of the argument) using content analysis and two reached strong inter-rater reliability (Cohen's Kappa, above 0.86). Interviews were analyzed using constant comparative method. Preliminary findings indicated that, in text-based discussions, low-levels of thinking skills were demonstrated and levels of thinking in response postings were particularly lower than in initial postings. In the audio-based structured argumentation activity, students demonstrated higher levels of thinking skills, and levels of thinking skills in response to postings were higher than initial postings. Students also participated in discussions with a substantial number of justifications to support their claims as well as rebuttals to weaken those of their peers. The overall quality of argumentation taking place within an episode included multiple rebuttals to challenge theses as well as evidence of their peers. Students reported positive learning experiences through the audio-based structured argumentation. They also described increased cognitive efforts to construct valid information and elaboration in their preparation and participation efforts. Based on findings, further discussion and implications regarding design of effective online discussion activities to promote learners' cognitive engagement will be presented.

2.25 Crowdsourced Lecture Transcription

Jia Chen Ren, Computer Science, College of Engineering
Mark Allan Hasegawa-Johnson, Electrical and Computer Engineering; College of Engineering
Lawrence Angrave, Computer Science; College of Engineering

ClassTranscribe leverages crowdsourcing to address the problem of accurate, reliable and fast transcriptions of lectures. Lecturers specify a particular audio or video file and a series of associated student transcribers. The file is then broken up into transcription tasks and automatically distributed with redundancy amongst the students. Lastly the completed tasks are intelligently reassembled into a complete transcription. Completed transcriptions can provide search functionality on top of existing lecture recordings and enable enhanced educational features such as closed captioning. These benefits along with the resulting conceptual reinforcement when transcribing lectures serve as a core motivation for students to participate. The transcription powered educational features enable the collection of unique engagement data that can illuminate the behavior of learners. This dataset can provide actionable feedback to lecturers and open up a whole range of new possibilities for machine learning, data mining and natural language processing in the educational context.

2.26 The Child Development Laboratory: Bridging Theory, Research and Practice

Meghan Fisher, Human and Community Development, College of Agricultural, Consumer and Environmental Sciences
Brent McBride, Human and Community Development; College of Agricultural, Consumer and Environmental Sciences

The Child Development Laboratory (CDL) facilitates the HDFS 494 course, which provides undergraduate students with opportunities to integrate and apply knowledge and skills gained in the classroom to real-world practice. Students in this course are immersed in the research literature on uses of standardized assessment tools with young children while gaining real-world experience conducting developmental screenings with children enrolled in the CDL. Students consistently rate the course-learning environment provided by the CDL as being a rewarding part of their educational experience at the University. A primary mission of the CDL is to create an environment in which students from a variety of departments can integrate theory, research and practice. Annually, 35-40 courses from multiple disciplines use the CDL to enhance student learning by facilitating projects involving one-on-one child participation, teacher training, and observational methods. By taking advantage of the CDL's resources, these courses offer a learning environment that bridges theory and research with practice by emphasizing practical and hands-on applications of the concepts being taught. Using the CDL as a mechanism for teaching, instructors provide a richer learning experience for students. The CDL proposes enhancing the infrastructure that facilitates students' ability to make connections between classroom learning and real-world settings. Creation of a database consisting of common data collected by projects using the CDL, and allowing this data to be accessed by other projects as needed would be the first step in this process. Such a database would limit participant burden while strengthening each project by supplying them with data that may not have been available due to funding, time constraints, or manpower. In implementing such a project, the CDL would recommend that projects explore not only how they can use existing resources, but also how they can contribute additional information to the database for future use by others.

2.27 Computerized Testing: A Vision and Initial Experiences

Craig Zilles, Computer Science, College of Engineering
Matthew West; mwest@illinois.edu; Mechanical Science and Engineering; College of Engineering
Wade Fagen; waf@illinois.edu; Computer Science; College of Engineering
Robert Deloatch; deloatc2@illinois.edu; Computer Science; College of Engineering
Cinda Heeren; c-heeren@illinois.edu; Computer Science; College of Engineering

In a large (200+ students) class, running exams is a logistical nightmare. Such exams require conflict exams and figuring out how to address the full range of Bloom's taxonomy learning goals in a manner that can be efficiently graded to give quick student feedback. Typically, these exam hassles lead instructors to have a few, large, multiple-choice intense exams, which can be suboptimal for student learning. In this talk, we will present a different vision and our initial experiences running a computerized testing center this past Fall semester. In this approach, the professor specifies a range of days for the exam and the student reserves a time of their convenience when the exam center is open. When the student arrives, their identity is verified and they are assigned to a machine that has been booted into the specified exam configuration (many different exams could be run in the testing center concurrently). The student logs in and takes their exam. Each exam consists of a random selection of parameterized problems meeting coverage and difficulty criteria, so each exam is different. The networking on the machine is configured to prevent unauthorized communication. We used the testing center this past semester for almost all of the exams in CS 233, a 200 student required computer science class. We'll discuss the mechanics of operating the testing lab, the work required by the instructor to enable this approach (e.g., generating a diversity of equivalent difficulty problems), data on when students prefer to take exams, and the student response, which has been strongly positive: 75% prefer computerized testing, 12% prefer traditional written exams, and 13% had no preference.

2.28 The Impact of Semantic Retrieval on Previous and Future Learning

Kristin Divis, Psychology, College of Liberal Arts and Sciences
Aaron S. Benjamin; asbenjam@illinois.edu; Psychology; College of Liberal Arts and Sciences

Studying new information and testing of the studied material is rarely done in isolation. Here, we show that what one does between studying and testing new information is important. In a set of experiments, we examined the influence of interleaved semantic retrieval on both previous and future learning within a multi-list learning paradigm. Interleaved retrieval led to enhanced memory for lists learned following retrieval. In contrast, memory was impaired for lists learned prior to retrieval. These results are consistent with recent work in multi-list learning, directed forgetting, and list-before-last retrieval, all of which indicate a crucial role for retrieval in enhancing mental segregation. This pattern of results follows clearly from a theoretical perspective in which retrieval drives internal contextual change and in which contextual overlap between study and test promotes better memory. These results also replicated with materials and assessments more appropriate for educational settings: interleaved semantic retrieval led learners to be more able to answer questions correctly about texts studied after a retrieval event but less able to do so for texts studied prior to a retrieval event.

2.29 Exploring Student-Centered Approaches to Improve Participation of Underserved Learners in MOOCs

Suma Bhat, Beckman Institute
Michelle Perry, Educational Psychology; College of Education

The ultimate goal of the proposed project is to produce a set of research-based guiding principles for designing and delivering MOOCs so that the intended audience, the under-served MOOC users (e.g novice learners from remote areas with limited economic resources), will be more likely to complete the courses successfully than has heretofore been the case. This goal will be realized by iterating between the following steps: (1) advancing the scientific understanding of learning. This will be done by examining existing clickstream data to detect when these learners abandon the course, (2) analyzing clickstream data and developing a model based on principles of learning, which could predict abandoning the course, (3) designing interventions with the use of innovative technologies that permit the inclusion of features that lead to survival and omitting features that lead to abandonment. We then go back to examine the new student data and revise the model, integrating the new data. This set of studies is sought to address pressing societal issues: first, it will point us to what sorts of behaviors characterize under-served MOOC users and, second, it will indicate what characterizes the under-served students who stay with the course and what aspects of the course compel these students to stay. This work aims to provide important insights about supporting under-served students, at scale. We expect that the proposed project will provide important answers and generate new questions about these processes.

2.30 Challenge-Inspired Undergraduate Education

Rohit Bhargava, Bioengineering, College of Engineering
Marcia Pool; mpool@illinois.edu; Bioengineering; College of Engineering
Dipanjan Pan; dipanjan@illinois.edu; Bioengineering; College of Engineering
Andrew M. Smith; smi@illinois.edu; Bioengineering; College of Engineering
P. Scott Carney; carney@illinois.edu; Electrical and Computer Engineering; College of Engineering

Many students choose engineering to change the world, but lose interest when faced with learning foundational concepts, which are presented without connecting their application to real-world problems. Therefore, to retain and further develop students, there is a need to connect student learning to engineering practice. In order to address this issue, we created the Cancer Scholars Program (CSP) where students, beginning freshman year, are solve a real-world problem through focused coursework and training opportunities. Traditionally, students learn engineering skills within isolated coursework without a connection to other courses or real-world problems, leading to a loss of interest in engineering. We anticipate the CSP will create a community of students who develop interest in engineering by learning to apply foundational principles to cancer research. To evaluate the CSP, aims and metrics for success were developed on three levels: program design and startup, steady-state operation, and outcomes. In Fall 2014, we enrolled twelve high achieving freshmen students (average ACT score = 33.8). Of these twelve students, five were female, four were first-generation students, and one was an underrepresented minority student. Students participated in a discovery course where talks on cancer research were delivered, followed by facilitated discussion. In spring 2015, students joined faculty research laboratories and began working on projects. Their junior and senior years will focus on cancer-related design work. Through this challenge-inspired program, we introduce students to engineering practice early, require them to retain and apply knowledge, and facilitate development of connections between engineering principles.

Session III–Lightning Talk Abstracts

3.01 An Educational Gaming Platform for Training Spatial Skills

Wai-Tat Fu, Computer Science, College of Engineering
H. Chad Lane, Educational Psychology; College of Education
Maya Israel, Special Education; College of Education

STEM education is immensely important to the future of our country, yet the US ranks below average in math and science education. One important factor for STEM success is spatial skills, such as the ability to transform between 2D and 3D abstract information, mental rotation and simulation, and spatial perspective taking. Spatial skills are known to predict success in STEM professions. They also transfer to different tasks and are malleable, and are therefore something that can be acquired and trained. Educational video games provide an excellent environment for training spatial skills. They combine constructivist, learner-centered, and scaffolding principles with real-time feedback and immersiveness and are well-suited for visual tasks. Games can be more effective teaching tools than traditional classroom instruction because they increase motivation and engagement. Our interdisciplinary team with expertise in STEM teaching and learning, game-based learning, computer science, and interactive system design is developing educational games to provide opportunities for K-12 students to acquire and practice three major aspects of spatial skills: spatial perspective-taking (orienting oneself relative to nearby objects), spatial visualization (transforming, extrapolating, and simulating 2D and 3D visualization of information), and spatial rotation (manually or mentally rotate 2D or 3D objects). Our system will utilize existing 3D modeling and game engines (e.g., Unity3D, Blender) as well as Leap Motion controllers to allow students to interact with different games with the platform (e.g., design spaceships to explore and collect resources in the virtual galaxy). Students will also get

a chance to collaboratively and competitively design and create 3D tools with 3D printers, with components that can be assembled together across groups. Systematic pre and post-testing will be conducted to measure how students can benefit in each component of spatial skills.

3.02 Using Computer-Adaptive Testing to Improve STEM Learning, Test Performance and Retention

Mestre, Jose; mestre@illinois.edu; Physics and Educational Psychology; Colleges of Engineering and Education
Anderson, Carolyn; cja@illinois.edu; Educational Psychology; College of Education
Chang, Hua-Hua; hhchang@illinois.edu; Educational Psychology; College of Education
Fabry, Gregory; glfabry2@illinois.edu; Electrical & Computer Engineering, College of Engineering
Gladding, Gary; geg@illinois.edu; Physics; College of Engineering
Kang, Hyeon-Ah; hkang31@illinois.edu; Educational Psychology; College of Education
Morphew, Jason; jmorphe2@illinois.edu; Educational Psychology, College of Education
Ryan, Katherine; k-ryan6@illinois.edu; Educational Psychology; College of Education

This interdisciplinary NSF-funded project combines expertise in testing/measurement, cognition, and STEM education to diagnose performance deficits prior to taking high-stakes course tests in introductory physics, and then to devise interventions aimed at remedying deficits found in order to improve course performance and retention. Computer adaptive testing (CAT) will be used to devise a cognitively diagnostic computer adaptive testing (CD-CAT) tool that accurately predicts students' future performance in tests prior to their administration. Research indicates that students are very poor predictors of their own performance both before, and even after, taking STEM high-stakes exams in gateway courses. Lower performing (yet well-prepared) students are especially poor at predicting their performance and hence are at risk of failing and eventually dropping out of STEM majors. The proposed CD-CAT tool will begin by providing a detailed diagnostic overview of students' strengths and weaknesses prior to taking midterm exams in a STEM course, and then using that diagnostic information to devise interventions that target those weaknesses, thereby improving exam and course performance, and in turn, retention. A significant fraction of students enrolled in science and engineering spend considerable effort in their gateway STEM courses yet reap little benefits from their efforts. We plan a targeted approach to help diagnose students' problem solving and conceptual weaknesses and then to address those specific weaknesses prior to their taking course exams.

3.03 Enhancing and Understanding Learning and Memory through Multimodal Training

Erick Paul, Beckman Institute
Ryan Larsen, Beckman Institute
Aron Barbey, Speech and Hearing Science and Beckman Institute

Recent innovations in cognitive neuroscience have advanced our understanding of the neurobiological foundations of human intelligence. Rather than engaging a single brain structure or operating at a fixed level of performance throughout adulthood, emerging evidence indicates that intelligence is mediated by a distributed neural system whose functions can be significantly enhanced by specific types of intervention. Early discoveries in the neurosciences revealed that experience could modify brain structure long after brain development is complete, but we are only now beginning to establish methods to enhance the function of specific brain systems and to optimize core facets of intellectual ability. It is now clear that experience alters the synaptic organization of the brain and that such changes reflect adaptive mechanisms for human learning and memory. In this presentation, we review recent findings from the INSIGHT study, which investigates the effects of adaptive cognitive training, high-definition transcranial direct-current brain stimulation, and physical fitness training on adaptive reasoning and problem solving. INSIGHT includes a cognitive battery spanning several cognitive domains as well as a comprehensive magnetic resonance imaging (MRI) protocol for assessing brain structure and function. Part of the battery focuses on fluid intelligence a critical cognitive construct supporting adaptive reasoning and problem solving. Our pre-intervention data reveals a positive relationship between fluid intelligence and brain health. In particular, we use MR spectroscopy to measure the concentration in the brain of N-acetyl-aspartate (NAA), which is thought to be a biomarker of neuronal health and viability and previously observed to correlate with cognitive ability in healthy populations. Scientific effort to improve the mind is driving progress in our understanding of human intelligence supporting new perspectives about its dynamic and adaptive nature and motivating new insights about how intelligence is shaped both by experience and underlying neurobiology.

3.04 Towards Scalability, Privacy, and Reliability in Peer Grading

Lav Varshney, Electrical and Computer Engineering, College of Engineering

Consider scalable assessment in education via peer grading, e.g. for massive open online courses (MOOCs). Students are often unskilled and unreliable, and so there is need to ensure reliable grading while also preserving some level of privacy to the other students' data. For this purpose, we propose a combination of random perturbation to mask the sensitive data and error-correcting codes for quality assurance. We also consider the possibility of collusion attacks by malicious students. We develop mathematical models to study the precise tradeoffs between grading performance quality, level of privacy against collusion attacks, and cost of invoking a large number of peers. Such a study provides design strategies and principles for peer grading. The use of classification codes may improve efficiency considerably.

3.05 Promoting Meaningful Participation in Online Learning Environments: Using Learner Analytics to Create Effective Feedback

Jessica Li, Education Policy, Organization and Leadership; College of Education
Allison Bell, Education Policy, Organization, and Leadership; College of Education
Debbie Hrubec, Education Policy, Organization, and Leadership; College of Education
Xue Yang, Education Policy, Organization, and Leadership; College of Education
Seohyun Lee, Education Policy, Organization, and Leadership; College of Education

Despite the abundance of learner analytics in many learning management systems, it is not clear how students access and perceive analytics and how that affects their motivation and participation- two factors critical for learning. This research will explore how learning analytics can be used as feedback messages to students to motivate student participation in an online learning environment. To achieve this objective, first, relevant learning analytics of student participation are selected, such as time spent, discussion post length, frequency, and quality. Then, feedback messages are designed to encourage participation and improve learning outcomes. A critical aspect of this research is to determine how messages are designed and how learner analytics are reported so they are personalized, easily understood, and clearly linked with ways of improving and optimizing student learning. Feedback message design dimensions may include time intervals, visualization, personalization, inclusion of comparative data, and multimedia. To examine the effectiveness of feedback message design, data will be collected using a survey based on the ARCS model, which defines approaches to the design of learning environments that motivate learners. The ARCS model consists of four dimensions: attention, relevance, confidence and satisfaction. A pilot is designed to examine different feedback designs derived from participation analytics affect students' motivation and engagement in an online graduate course in the social sciences. Students will be randomly assigned into groups that receive different feedback messages about their participation over a 6-week period. A pre and post survey will be administered. We will examine attitudes toward the feedback messages and student perceptions of how messages did (or not) contribute to their willingness to participate and learn. This pilot will inform our future studies, which continue to examine how learning analytics can be fruitfully used to motivate participation, learning in online learning environments. Students' demographic variables are included.

3.06 Let's Perceive Together: Toward a New Generation of Large-scale Tools for the Understanding and Extraction of Emotions in Text

Roxana Girju, Linguistics and Computer Science, College of Liberal Arts and Sciences and Beckman Institute

The common theme of the 21st Century Grand Challenges is not only ambitious but achievable goals that harness science, technology, and innovation to solve important problems, but also a better understanding of the human knowledge about ourselves and the world around us (President's Strategy for American Innovation, 2013). One task that fits this description is the advancement in the understanding and extraction of human emotions from text, in particular social media. We propose a new generation of advanced tools for the in-depth study and extraction of emotions in text: What are emotions and how are they induced through various senses? How do we perceive them? What is the best design/model for the automatic analysis, extraction, and inference of emotions? Since human communication relies on many senses, beyond the visual and auditory, our goal is to re-examine ways to represent textual data to better make the information available. Such a task would foster collaboration among researchers from various areas such as cognitive science, psychology, education, linguistics, computer science, health informatics, and artificial intelligence. This will also benefit a wide range of applications: 1) Health informatics (health assessment: how emotions influence body organs and overall health); 2) Personalized Learning Environments (tailoring learning to individual needs, preferences, aptitudes); 3) Virtual Reality (generating and inducing emotions; using artificial synesthesia and combining various senses to control human attention); 4) Automatic Tutoring (investigating and providing feedback to student emotions during learning); and last but not least, 5) New Perceptual Environments for Textual Information (Text is boring. We look for new ways of efficient information transmission: alternative sensory channels (beyond visual and auditory) will create more immersive/affective/realistic context and content for the audience. This would help break cultural barriers, reach audiences with sensory disabilities, foster learning and creativity; e.g., new sensory experiences of textual content in museums).

3.07 Collaborative Patient Portals: Leveraging Conversational Agents

Dan Morrow, Educational Psychology, College of Education
Mark Hasegawa-Johnson, Electrical and Computer Engineering; College of Engineering
Renato Azevedo, Educational Psychology, College of Education
Kuangxiao Gu, Electrical and Computer Engineering, College of Engineering
Daniel Soberal, Electrical and Computer Engineering, College of Engineering
Thomas Huang, Electrical and Computer Engineering, College of Engineering

Learning is vital to health across the lifespan, in part because patients are increasingly responsible for self-care. This is especially so for older adults, who have more chronic illness yet fewer cognitive resources for self-care. Because learning is often mediated by technology, success of self-care depends on whether these environments are designed for older adults. For example, patient portals to Electronic Health Records should bridge self-care and primary care by ensuring patients continuous access to health information. However, older adults, who may benefit the most from portals, use them less often because of cognitive/literacy/numeracy constraints. We hope to improve older adults understanding of clinical test results because portals have expanded provision of this information. According to comprehension theory, patients must do more than remember specific numbers in order to understand test results. They must integrate the cognitive meaning (How great is my risk of stroke?) and affective meaning (Is my health threatened?) of the information to extract the gist, or bottom-line for their health. This representation is organized around affective categories.

3.08 PrairieLearn: An Adaptive Online System for Mastery Learning

Matthew West, Mechanical Science and Engineering, College of Engineering
Craig Zilles, Computer Science, College of Engineering

PrairieLearn is an experimental web-based system for online homework and other assessments. It is designed to allow repeated attempts at randomly generated questions, and uses a Bayesian estimator to track students' current ability level on the assessment. Students are free to attempt or re-attempt questions in any order, but they are adaptively guided by the system by adjusting the points that each question is worth. The point adjustment algorithm is designed to encourage students to learn to mastery, but to balance this with spaced repetition of questions to assist longer-term retention. We present results from the use of PrairieLearn in large introductory courses in Theoretical and Applied Mechanics (TAM) and Computer Science (CS) at Illinois.

Session IV–Lightning Talk Abstracts

4.01 STEM Learning through Technology-Enabled Physicality

Robb Lindgren, Curriculum and Instruction, College of Education
Guy Garnett, Illinois Informatics Institute
Jose Mestre, Physics and Educational Psychology; College of Engineering and College of Education

This research seeks to (1) understand the physical and embodied foundations for learning and reasoning about complicated topics in STEM, and (2) design new simulation and game technologies that take gestures and other physical activity as input. I will be discussing a project recently funded by the Cyberlearning Program at the National Science Foundation, which seeks to support transformative advances in computer technologies that complement our emerging understanding of how people learn. This work represents collaboration between faculty and students at UIUC in Education, Informatics, and Computer Science. Together we are conducting studies of how students reason about big ideas that cut across science and engineering content, and how their gestures support their reasoning and understanding. These findings are being fed into the design of a gesture recognition system that will look specifically for students' body actions that are learning-relevant. Unlike commercial gesture recognition systems, our designs will be tailored to look specifically for expressions of ideas such as scale rates of change, and they will require minimal training for an individual student. The intent is to create what we are calling simulation theaters that allow learners to interact with simulations in multiple topic areas using a common scheme of embodied interaction. The desire is to facilitate more transfer of learning and more robust understanding of critical concepts in STEM. This project also affords opportunities to develop new analytic and data mining techniques specifically targeted at how students move. We imagine possibilities for assessing student learning, not through written or verbal assessments, but careful analysis of their movements and the physical representations that they create.

4.02 Encouraging Innovation, Enhancing Research, and Facilitating Economic Development through the Transfer of Intellectual Property

Svetlana Sowers, Office of Technology Management
Steve Wille, Office of Technology Management
Nicole Nair, Office of Technology Management

The Office of Technology Management (OTM) evaluates, protects, markets and licenses Intellectual property created by the researchers at the University of Illinois. We are part of the University's technology commercialization infrastructure that also include Illinois Ventures LLC (provides consulting, business development, and competitive funding opportunities), and Research Park/Startups Incubator (provides services and encourages R&D between industry, startups, and University). Here is OTM by the numbers for FYI 2014 (for Urbana-Champaign campus): 179 disclosures, 38 licenses and options, 6 new startups, over 150 other agreement including copyright permissions; we filed 203 patents, 78 issued, and have earned $5.23M in royalties. With the new I-POC (Proof of Concept) funding launched in Spring 2014, OTM seeded 5 projects with $195,000, resulting in 5 new companies from 5 different departments and institutes. One of the companies Illiac, Inc., based on Harmonia software from FAA/School of Music, facilitates online teaching and learning of music theory. Other examples of innovations in learning sciences are: An online platform for hosting electronic books (eText, Inc. based on ACES/CITES technologies), an eLearning environment for K-12 (Common Ground Publishing, Inc., from the College of Education), i-Metro kiosks for displaying up-to-date public traffic information (FAA/School of Architecture), a framework for developing collaborative pen-based applications (Computer Science, now released to open source). We signed legal agreements with Apple and Google to provide free mobile applications development environment to University community for creation of research and education related mobile apps. Since the launch in 2010, we had 39 mobile apps and 154,000 downloads (5 continents) for iPhone and iPad. OTM continues to develop new venues for disseminating and commercialization innovation, including showcasing technologies to corporate partners and VCs ("Share the Vision" events) and co-hosting "Supporting Innovation & Creativity: A Conversation with the Arts, Humanities & Social Sciences" event.

4.03 Sketch Recognition Technologies for Creation, Learning, and Assessment

Joshua Peschel, Civil and Environmental Engineering, College of Engineering
Emma Mercier, Curriculum and Instruction, College of Education
Geoffrey Herman, Illinois Foundry for Innovation in Engineering Education; College of Engineering

Graphical communication is a critical mode of interaction for learners and practitioners in a wide range of disciplines. Mathematics, computer science, engineering, music, economics, and philosophy are only a few of the domains that use hand-sketched diagrams to aid in active learning and creative processes. Designers and artists draw, scratch, and refine throughout the development process. The unrestricted nature of sketching facilitates visual thinking, spatial organizations, and brainstorming and it can uniquely aid in the pursuit of content and concept understanding. Unfortunately, there is a gap between the free-flowing process of creation and the hard-lined execution of a product. Much of today's software is geared toward workflow and processing designs. This eliminates a great deal of the creative problem solving found in sketching. Similarly, in education, correcting hand-sketched diagrams is perceived as superfluous leaving students with little critical feedback and few opportunities to develop this skill that would allow them to communicate with their peers during coursework, and become an effective collaborator when they enter the workforce. The focus of this talk is a research program designed to bridge this gap: sketch recognition for learning. Sketch recognition is the automated processing and understanding of hand-sketched designs that can complement instructional activities by correcting student-drawn diagrams to provide immediate learner and instructor feedback on the sketching process. These tools are being examined in a range of contexts - homework assignments, individual learner activities and collaborative classrooms.

4.04 Game-Based Virtual Internship Environments

Maya Israel, Special Education, College of Education
John Abelson, Materials Science and Engineering; College of Engineering
Clifford Singer,Nuclear, Plasma and Radiological Engineering; College of Engineering
H. Chad Lane, Educational Psychology; College of Education
Wai-Tat Fu, Computer Science; College of Engineering
Ty Newell, Mechanical Science and Engineering; College of Engineering

Our interdisciplinary research team with expertise in STEM teaching and learning, learning sciences, computer science, engineering and political science is developing game-based virtual internship environments that integrate technologies to provide learners with authentic professional experiences, thus deepening their understanding of the professions. These systems focus on integrating real data systems and simulation software into gamified environments. Students enter these learning systems through multiple pathways that include (i) progressively more complex professional problem scenarios, (ii) use of graphically intuitive visualizations of physical systems and data, and (iii) a focus on multiple stakeholder perspectives to solve real-world STEM problems. Our initial systems involve the design and construction of energy efficient homes (EcoBuild) and decision-making to reduce climate change emissions (CAGE), but with the ultimate goal of generalizing findings from these prototypes to other virtual professional experiences. Through an iterative development process that makes use of Universal Design for Learning (UDL; CAST, 2011), we are attempting to meet the needs of a broad range of K-12 and college-level learners. For example, by integrating quantitatively accurate professional data systems with graphically intuitive visualization methods, we provide students will multiple means of learning about complex processes such as heat flow and solar radiation or trapping. EcoBuild makes use of simulation software developed by Newell (College of Engineering) called ZEROS: Zero Energy Residence Optimization Software, a predictive model related to building energy efficient homes, which will serve as the real-world STEM data structure within our system. The CAGE project makes use of a simulation developed by Singer (Colleges of Engineering and Political Science) that couples macroeconomic development, fossil fuel use and climate change. This allows the user to explore the outcomes that result from various levels of investment to decarbonize energy sources versus continued fossil fuel burning that requires adaptation to significant climate change.

4.05 Lowering the Cost of Playfulness: Unlocking the Potential of Mobile and Virtual, and Unrestricted Computational Environments

Lawrence Angrave, Computer Science, College of Engineering

We present four teaching technologies that break from the traditional ‘restricted IT’ mold: A playful Java-programming-in-the-browser; a complete virtual-computer-in-the-browser with integrated videos; a $50 programmable Android tablet for every student and 400 cloud-based unlocked virtual machines with administrator rights - one for every enrolled student in a large-enrollment course. The unifying themes of these approaches are two-fold. First, they aim to encourage exploration, playfulness and discovery while reducing the time-cost and risk of these actions. For example if the student crashes the browser-machine, all they need to do is restart their browser. Second, the themes aim to remove infrastructure IT constraints that conflict with or dampen students’ engagement and course content. We report on the success of each of these technologies and their impact so far including traditional on-campus teaching, a planetary-MOOC scale course, out-reach summer camp, and non-course-based learning opportunities. The Java- and Linux- in-the-browser simulations enable on-campus and distant learners to engage with course content in an immediate and playful interaction that otherwise require specific platform installation and specific hardware requirements. Further these tools can be instrumented using micro-event-logging frameworks (for example Google Analytics vs. an on-campus micro-logging framework) to log how students interact and explore the learning environment. We will also highlight unexplored opportunities, current difficulties and limitations of developing similar tools and systems.

4.06 Virtual Sprouts: Game-based,Iintelligent Learning Technologies for Science Education and Behavior Change

H. Chad Lane, Educational Psychology, College of Education
Donna Spruitj-Metz, USC Keck School of Medicine
Marientina Gotsis, USC School of Cinematic Arts
Gisele Ragusa, USC Viterbi School of Engineering
Jaimie Davis, UT-Austin School of Human Ecology

The Virtual Sprouts project is a 5-year NIH Science Education Partnership Award that seeks to address pediatric obesity for at-risk children (ages 8-11) in southern California. By leveraging the appeal of gardening, video game technologies, artificial intelligence, and outreach networks, the Virtual Sprouts game promotes science learning with fun in the kitchen. As part of a larger effort to promote dietary behavior change (including LA Sprouts, a broad-reaching urban gardening sister program), Virtual Sprouts is designed to combine educational goals, engaging game play, positive attitudes about health, and foster family dialogue around healthy foods and lifestyles. The Virtual Sprouts team is highly interdisciplinary, including experts in behavior change, education, game design, pedagogical agents, gardening, and health-related outreach. While playing the game, kids hear the story of Dotty, a Lady Bug who wants to become a master chef to help the humans that take care of her home, but needs help. Dotty stays with the learner during the game, providing help she or he is stuck, offering science-based hints about gardening and nutrition, and giving encouragement to explore and enjoy the various game scenes. Dotty is driven by a rule-based cognitive model of coaching that is linked to the Next Generation Science Standards and employs traditional techniques from intelligent tutoring systems. Further, as a video game, scores are provided that gauge success and help the learner understand their own performance. A recent study in 6 classrooms in in the LA Unified School District showed that use of Virtual Sprouts, when compared to a traditional curriculum without the game, produced important pre-cursors to behavior change, including increased self-efficacy for eating fruits and vegetables and total motivation to improve health. Virtual Sprouts is entering its final year of funding that will include a large-scale evaluation and public release of the game.

4.07 Learning Critical Thinking at Scale: Automated Assessment of Complex Assignments for MOOCs

Chase Geigle, Computer Science, College of Engineering
Chengxiang Zhai, Computer Science, College of Engineering
William Cope, Education Policy, Organization and Leadership; College of Education
Duncan Ferguson, Comparative Biosciences, College of Veterinary Medicine

The Massive Open Online Courses (MOOCs) have not only made education more affordable and scalable, but also offered a novel paradigm for learning that has many potential advantages over traditional classroom learning, including personalized learning. A key component technology that enabled the success of MOOCs is the automatic grading capability of a MOOC system. Unfortunately, the current technology for automatic grading is unable to grade complex assignments that are needed for teaching complex concepts or skills (e.g., critical thinking skills), making it difficult for students to learn critical thinking skills through MOOCs. We will present our vision of leveraging machine learning and information retrieval technologies to develop computational algorithms for automating assessment of complex assignments to enable learning critical thinking at scale and to facilitate personalized learning. Specifically, we envision to develop the following intelligent software tools: 1) a grade predictor that would learn from a sample of graded assignments to automatically assign grades to ungraded ones in multiple dimensions of grading rubrics; 2) an assignment sorter that would cluster ungraded assignments so as to reveal the major categories of answers of the students, enabling batch assessment of multiple assignments in the same category and revealing patterns in student work to help assess effectiveness of student learning; 3) a grading workflow manager to minimize the overall grading effort of an instructor by using active machine learning techniques; and 4) a student performance analyzer that can provide personalized assessment and feedback to individual students. We implemented and evaluated some of these proposed techniques using case exercises developed with the Applied Learning Platform (www.WhenKnowingMatters.com) as part of a veterinary course taught at the University of Illinois at Urbana-Champaign, and obtained very promising initial results, which will be presented at the Symposium.

4.08 Learning with Text and Image: The Relationship of Text-Image Integration to Interest and Comprehension

Matthew Peterson, School of Art and Design, College of Fine and Applied Arts

Abstract: How does the level of integration of text and image impact learners? Working memory theory, dual coding theory and cognitive load theory are all predicated on separate and complementary resources for processing propositional (text) and pictorial (image) information. Concepts are reinforced when presented in both propositional and pictorial formats, and when connections are made explicit. The relationship of text and image in compositions should have direct impacts on learning. A Ph.D. in Design study is outlined, which addressed the design of instructional media both holistically and authentically by focusing on text–image relationships at the level of design strategy. Three text–image integration strategies are proposed and illustrated: prose primary (PP), with a central prose column and marginal imagery; prose subsumed (PS), with shorter prose segmented by imagery; and fully integrated (FI), where smaller textual chunks populate imagery. Science textbooks are predominantly designed with the lowest level of integration, PP, though instances of PS and FI can usually be found amidst PP pages. Over 150 middle school students participated in a within-subjects design, each receiving one spread (two pages) apiece of the three strategies. Text–image integration strategies were tested for comprehension of abstract concepts and interest in media (situational interest). Subjects' selections of interest strongly favored higher levels of text–image integration, such that FI was rated more interesting than PS, which was in turn more interesting than PP. Interest-level results were rated reliable and significant at a 95% confidence level. Subjects completed comprehension tests using the supplied media. Comprehension results were less conclusive, with one treatment of FI proving significantly more effective than PP ($P<0.05$). Learning was not directly measured, but could be measured in a more extensive study using the same underlying research design.

4.09 Improving Contexts for Learning from Science Simulations with Gestural Inputs and Adaptive Framing

David Brown, Curriculum and Instruction, College of Education
Robb Lindgren, Curriculum and Instruction, College of Education
H. Chad Lane, Educational Psychology, College of Education

Dynamic and interactive simulations can help to develop students' understanding of important ideas in science. But the ways of interacting with simulations and the framing of the simulations can benefit from technological innovations guided by careful observations of students using the simulations. With current interfaces, students typically interact with the simulations through mouse or track-pad inputs. But with increasing availability of devices that take gestures and bodily movements as inputs, the simulations can be redesigned to take conceptually congruent bodily motions as inputs. In particular, some gestures might allow students to control unobservable elements such as molecules, allowing for deep immersion in the simulations. With regard to the framing of simulations, typically interactions with simulations are guided by a fixed sequence of web pages, or in a classroom context, by a static worksheet asking students to focus on certain aspects of a simulation and record their observations and thoughts. However, while some students will express certain explicit ideas and make certain implicit assumptions, and so will be helped by particular interactions with the simulations, other students will express different explicit ideas and make different implicit assumptions and so will learn better through different interactions with the simulations. With careful observations of the variety of ways that students progress through the simulations to develop understanding with the help of a human tutor, this data can lead to the design of online framing that adapts to different students' interactions with the simulations, both drawing on and contributing to advances in adaptive framing of learning contexts in conceptually rich areas.

4.10 Beyond PowerPoint: Mobile-first, Dynamic, Trackable Presentations in HTML5

Wade Fagen, Computer Science, College of Engineering

In today's college classrooms, nearly every student brings his/her own computing device; often a cell phone, sometimes a tablet, laptop, or other device. Instructors and researchers alike have made some attempts to leverage this landscape, though few classrooms have adopted any use of student's own computing devices as part of their everyday practice. Published research has identified many barriers toward this adoption, noting tasks as simple as viewing a PowerPoint or PDF slide deck on mobile devices require the need to install specialized apps. Reveal.js is a popular mobile-first, responsive JavaScript library that allows for HTML or Markdown syntax to be presented as beautiful, dynamic slides within a web browser. Just like PowerPoint, presentations in Reveal.js can be presented full-screen, include slide transitions, images, and dynamic elements. Instead of running in PowerPoint, these presentations run inside of a web browser. This enables the entire Internet to be available for presentation including embedding dynamic content such as YouTube videos, interactive examples, and clicker-style questions. More than increasing accessibility and content, Reveal.js opens up an exciting set of tools to expand active learning. One interesting use includes a 'participation checkpoint' where future slides are locked until a criterion is met. This may be individual (individually a user completes the checkpoint to unlock the next slides) or more dynamic where a proportion of active users must complete an interactive activity on their device before the lecture continues. As all of this exists with a web browser, tracking how long a student spends on each slide, each activity, and each checkpoint is trivial and can be done with tools such as Google Analytics. This lightening talk will be presented using Reveal.js and will outline some interesting research directions that is being explored using Reveal.js in classrooms right now here at Illinois.

4.11 CD-CAT--From Adaptive Testing to Adaptive Learning

Hua-Hua Chang, Educational Psychology, College of Education

Computerized Adaptive Testing (CAT) is a method of administering tests that adapts to the examinee's trait level, and it has become popular in many high-stakes educational testing programs. When a CAT is built on Cognitive Diagnostic (CD) models, it can be effectively utilized to identify examinees' latent cognitive profiles, or skill mastery patterns. A growing body of evidence shows that the CD-CAT methods have enormous potential to revolutionize classroom assessment and greatly facilitate individualized learning. In a one-to-one instructional environment, the content and pace of instruction can be completely customized to best fit the observed progress of a particular student allowing the teacher to better focus on the individual's specific needs and problems. This presentation will show how CD-CAT can be used to expedite such teaching on a mass scale.

4.12 The Art of Scientific Visualization for Learning and Outreach

Donna Cox, National Center for Supercomputing Applications
Robert Patterson, Advanced Visualization Lab; National Center for Supercomputing Applications
Stuart Levy, Advanced Visualization Lab; National Center for Supercomputing Applications
AJ Christensen, Advanced Visualization Lab; National Center for Supercomputing Applications
Jeff Carpenter, Advanced Visualization Lab; National Center for Supercomputing Applications
Kalina Borkiewicz, Advanced Visualization Lab; National Center for Supercomputing Applications

Advanced data visualization tools, virtual displays, and interactive systems at the National Center for Supercomputing Applications (NCSA) promise powerful avenues for education and learning at the University of Illinois. Donna J. Cox, MFA, PhD, is Director of the Advanced Visualization Laboratory at the National Center for Supercomputing Applications, Lead for NCSA's Culture and Society Theme, Director of eDream Institute, and Professor in School of Art and Design, University of Illinois. She will provide a highly visual presentation and demonstrate the making of high-resolution time-evolving visualizations from massive data. These will include challenges in visualizing big data science from Blue Waters, a National Science Foundation project at NCSA. She will show a video of interactive visualization tools within NCSA's 4K3D Theater and Creativity Lab, unique labs for interdisciplinary research and education. The Virtual Director environment enables interactive navigation of data to design virtual scenes. It also provides interactive remote collaboration among researchers and educators located at external sites such as the Adler Planetarium in Chicago. She will give a glimpse into rapidly expanding global digital domes in museums and science centers around the world. These full dome environments are now scaled to classrooms and portable environments. From hurricanes to supernova, AVL's data visualizations have become centerpieces in a variety of scientific documentary programs that reach millions of people. She will play excerpts from celebrity-narrated IMAX films and museum shows that immediately provide insight into mysterious natural processes through data visualization. These examples expand possibilities for new ways of teaching and measuring how data can improve learning. NCSA's Culture and Society Theme is exploring collaborative opportunities in learning environments and expanding efforts across campus to synergize around emerging technologies that enhance research and education.

Closing Remarks - Next Steps

Index: Authors and Co-Authors