Emerging Learning Sciences: Bridging theory and practice of formal and informal learning

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In the rapidly growing "learning sciences," theory and reality feed each other. As we gain deeper understanding of learning in real-world situations, we become better equipped with theory and practical knowledge to design better learning environments, and this cycle iterates. Three leading researchers will illustrate the current progress of this science.

Quest to Understand Life-wide Learning and Inform Learning Environment Designs

Roy Pea, Stanford University—LIFE Center

We need to develop a learning science that explains and can guide robust learning and adaptive transfer in today's fast-changing world. I describe highlights of the interdisciplinary inquiries of the NSF-funded LIFE Center into the nature of "life-wide" learning so as to contribute scientific understanding of human learning and generate design-relevant knowledge for improving learning. We focus on understanding the relationships between informal and formal learning processes and outcomes, across informal and formal learning contexts. How do learners navigate these boundaries and transfer learning into and out of situations? We identify and investigate underlying principles of how people learn that address key research questions from a variety of disciplines (neurobiology, cognition, development, and socio-cultural), by sparking 'conceptual collisions' among these viewpoints and seeking points of integrative insights. We are investigating the social and material organization of learning and cognitive practices in developing math, science and technological fluencies; how individuals span different nodes in "learning ecologies" with help from "learning brokers"; how individuals learn by creating their own learning resources; the influences of one's developing self-identity in social networks on the demonstration of competencies and exploitation of opportunities to learn across settings; and the role of "people knowledge" in guiding learning and memory and seeking out new knowledge and understanding. We will share an ongoing analysis of these relationships of the informal and formal and characterize what we see as some of the major bridging opportunities, as well as intrinsic differences in kind that may make connections resilient to design change.

"Learning by Design" and beyond

Janet Kolodner, Georgia Institute of Technology

Learning by Design (LBD), a project-based inquiry approach to science learning, emerged from the process model of cognition suggested by case-based reasoning. We used what we know about cognition to fashion a learning environment appropriate to deeply learning science concepts and skills and their applicability in parallel with learning cognitive, social, learning, and communication skills. LBD's design combines CBR's suggestions about promoting learning from experience, problem-based learning's framework for managing classrooms in which students are learning in the context of problem solving, and lessons we learned about middle school children and classrooms as we worked towards making LBD work in real classrooms. Through LBD's design, we learned much about relationships between cognition, social interactions, and culture, and LBD implementations serve to enact a large range of practices that the transfer literature has identified as important for deep and transferable learning. Investigations conducted in LBD classrooms, in turn, allow us to examine interactions between cognition, social cognition, and culture, allowing us to add to cognitive science's foundational knowledge about learning. Using LBD classrooms as our infrastructure, we've recorded the development of scientific reasoning in an environment engineered to promote transferable learning and identified characteristics of the environment (social and cultural) that have important impact on children's development.

Theory-driven Design for Promoting Learning Activities in Community Settings

Michael Cole, UCSD

In this talk I will describe a program of research intended to test and refine a theory of learning and development through the design, implementation, and effort to sustain learning activities in community settings such as youth clubs, churches, libraries, and schools after school. I refer to the theoretical framework for this effort as Cultural-historical Activity Theory. It derives from a combination of the ideas of Russian psychologists inspired by Vygotsky, American cultural anthropology, and the ideas of the American pragmatic philosophers such as John Dewey. This effort faces major theoretical and methodological challenges which will be the focus of the discussion. It is necessary, first of all, to design the activities to fit their local socio-cultural context, taking into consideration the time and institutional setting and the cast of participants in the activities. Second, it is necessary to create multi-modal, multi-media techniques for recording the activities and finding suitable indexes of changes in performance on socially-valued indicators (texts, portfolios, test scores). Third, it is desirable, if not necessary, to find suitable comparison groups in the hopes of being able to estimate "effect sizes." Fourth, it is necessary to find appropriate means of communicating the results. Fifth, it is necessary to create the infrastructure for tracking the systems under investigation over a period of years. All five of these requirements have been implemented in limited ways that indicate the potential of this approach to research on learning. Realizing that potential is a major task for the future.