Models of Learning and Theories of Practice for Informal Learning Environments

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Overview of Symposium

While studies of learning and learning environments have predominantly taken place in laboratories and formal educational settings, there is a growing community of researchers conducting studies in non-school settings such as museums, after school programs, homes, zoos, workplaces, and other informal learning environments (e.g., Callanan & Jipson, 2001; CILS; Leinhardt, Crowley, and Knutson, 2002; Martin, in press; Museum Learning Collaborative). One goal of informal learning research is to contribute to an understanding of how to support those students who fail to learn through traditional formal approaches to education.

While researchers and practitioners continue to debate the definition of informal learning and its relationship to formal education, there are some core identifiable features – learning is self-directed, the administration or sponsorship of the learning activity is not always present, activities have unsystematic, fluid arrangements in participation, time, and space; and learners represent a diversity in groupings, age, race, and ethnicities. Thus, will prior research on cognition, learning, and reform-based schooling be sufficient to conduct research about informal learning, or is there something fundamentally different about the ways in which out-of-school learning occurs that require a reconceptualization of the model of the learner and new infrastructures for organizing informal activity systems? Will this necessitate the development of new theories of practice?

This symposium shares examples of projects being addressed by researchers who have been designing, studying, and practicing in informal settings as well as working at the intersection of formal and informal learning institutions. Our goal is to draw upon examples of informal learning research, discuss key tensions in informal learning research, and understand how and where this body of research fits into the larger educational research landscape. With our discussants (Duschl & Sabelli), we invite critique of our discussions in light of prior psychological, cognitive, and social-cultural traditions, as well as share policy implications for informal learning research.

We have identified three areas of discussion:

Formal-Informal Dualism

Are current models of learning derived from laboratory studies and studies of formal schooling sufficient for studying learning and teaching as it occurs in informal contexts?
Is the distinction and dualism created between informal and formal learning a productive one to make?

The defining characteristics of the formal and informal learning environments have been well documented (Hofstein & Rosenfeld, 1996: Wellington, 1990). However, the degree to which these two contexts can inform the practice of the other and the appropriateness of inferring theories and methods between the two remains controversial. Wertsh (chapter 7, 2002) acknowledges that the informal setting is a different sociocultural setting from classrooms and cautions researchers in the degree to which we infer findings from one context to the other. Additionally, informal learning is largely concerned with the processes of learning and does not focus on product outcomes such as test scores. Such products are not available or suited to the exploratory nature of museum environments and studies suggest that such measures do not transfer well to the study of learning in informal environments (Falk & Dierking, 1992; Hein, 1998).

Perhaps clarifying similarities and differences between these two contexts is of little importance. Rather, the informal space should be viewed as a "rich variation (Bartels & Hein, 2003)" that can offer unique perspectives

on learning such as how parents and children engage in everyday thinking (Crowley, Callanan, Jipson, Galco, Topping, and Shrager, 2001) or how motivation and engagement influence self-directed learning (Paris, 1997).

Issues of Theory and Practice

Are social-cultural theories of learning or design-based research methods adequate to interpret, analyze, and build models of informal learning?

What are some 'theories of practice' being generated by studies or enactments of practice in informal learning environments?

What practical interventions can be designed to improve learning, yet preserve the spatial, social, and, cultural context in which informal learning takes place?

How is 'design for learning' or 'teaching for understanding' achieved in environments in which activity is self-directed and/or occurs in family groups?

While numerous studies have explored learning processes and outcomes of individual and groups in informal settings (Allen, 2002; Crowley et al., 2001; Diamond, 1986), it is only recently that this field has begun to develop more generalizable theories and models of informal learning. For example, Schauble, Leinhardt, and Martin (1997) encourage museum researchers to study learning as informed by socio-cultural theory which "emphasizes that meaning emerges in the interplay between individuals acting in social contexts and the mediators - including tools, talk, activity structures, signs, and symbol systems - that are employed in those contexts." Additionally, Falk and Dierking (2000) promote a model of learning in museums that connects personal, socio-cultural and physical contexts together. George Hein (Chapter 5, 1998) encourages researchers to embrace network, as opposed to linear, theories to model the learning process of visitors in museums and discusses at length (Chapter 2) how different theoretical commitments influence the process of designing educational artifacts and environments.

Design-based research is an emerging paradigm to systematically study educational innovations outside of a laboratory setting in the natural, complex activity space (Brown, 1992; Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003; The Design-based Research Collective, 2003). This research approach is used to create and assess educationally-relevant interventions in which designs embody hypotheses about learning, and interventions are iteratively refinement and studied (DBRC, 2003). Rather than attempting to isolate particular variables to study in a complex setting, salient variables and their interrelationships are identified (Collins, Joseph, & Bielaczyc, 2000). Design-based research may be particularly relevant to the informal learning community as we seek to study and design for learning based on theories that account for the unique characteristics of this context. Examples of theory-informed design and iterative redesign to promote learning in the informal setting include work by Schauble and Bartlett (1997) and Borun, Chambers, Dritsas, and Johnson (1997). Studies in progress by Finke at the Lawrence Hall of Science in Berkeley and King at the Natural History Museum in London also provide examples of design-based interventions.

Research Policy

What are the nature, attributes, strengths, and characteristics of effective informal learning environments that can influence and transform formal institutions, settings, student learning, and teacher practice?

What is the role of institutional policy, sponsorship, and administration to enable informal learning research between (or in) education institutions?

How does informal learning research fit into the learning sciences?

General research in museums has a history of over 100 years (Hein, 1998), while studies that focus specifically on learning and cognition have gained considerable momentum in the past 20 years (see Dierking & Falk, 1994 and Ramey-Gassert, Walberg, & Walberg, 1994 for a review of the literature). Informal learning research remains somewhat invisible to the larger educational research community (Bartels and Hein, 2003) and our understanding of learning and facilitating in informal settings may, arguably, lag behind classroom-based research by about 10 years (Schauble and Bartlett, 1997). To advance this field, several efforts are underway: the Center for Informal Learning and School a partnership between Kings College London, UC Santa Cruz, and The Exploratorium is supporting leadership development for effective informal science education and institutional alliances, as well as synthesizing a research framework to define areas of study about informal learning environments and their links to learning in formal settings. Second, a recent policy statement was issued from the informal learning community (Dierking, Falk, Rennie, Anderson, & Ellenbogen, 2003) to promote six avenues of

research: 1) exploring precursors to learning, 2) taking the physical setting into account, 3) exploring social and cultural mediating factors, 4) promoting longitudinal research, 5) investigating the process of learning, and 6) expanding our research methods. These will be discussed in the context of advancing the agenda for learning sciences.

Islands of Expertise: Following the Child through Everyday, Informal, and Formal Learning Environments

Kevin Crowley, University of Pittsburgh

It has been common for learning theorists to recognize the simultaneous presence and impact of different time scales in development. What is less clear is how these levels interact to produce individual development. The everyday experiences that are the currency of development are small, mundane, and relatively simple. And yet the changes that they shape over time can be large, extraordinary, and complex. Drawing upon examples of family learning in museums, I will describe a model for the development of discipline specific literacy that can bridge this problem of the mechanisms of learning operating on one time scale and outcomes emerging on another. The theory, a synthesis of socio-cultural and information processing frameworks, develops the idea of "islands of expertise" as shared family knowledge that can serve as a platform for advancing conversations about and learning in the disciplines in museums and other informal environments.

Interaction, Mediation and Intervention in *Investigate*

Heather King, King's College London
In collaboration with staff at The Natural History Museum, London

As the body of research concerned with maximizing learning opportunities in museums continues to grow, there is limited mention of the role that museum educators, commonly known as Explainers, can play. To address this gap, my research focuses on the role of Explainers in the hands-on gallery *Investigate* in London's Natural History Museum. In this paper, I describe the existing patterns of social interaction and multiparty talk that occur between Explainers and students. The analysis concentrates on the support for reflective discourse and scientific enquiry within the space, which, while rich in stimuli, scientific tools and reference material, offers little in the way of explicit guidance. The analytical framework builds on techniques developed to assess discourse in the classroom and in informal settings. Finally, I describe the implementation and impact of a series of interventions, developed in partnership with Explainers using a design-based research methodology, aimed at increasing the incidence of scientific enquiry.

Designing Exhibits for Collaborative Learning

Coe Leta Finke, University of California at Berkeley
Lawrence Hall of Science and UC Berkeley Graduate School of Education

Through my work as both an exhibit developer and researcher, I seek to adapt a design-based research approach to study and design for collaborative learning in informal settings. One of the challenges facing museum staff is designing artifacts and exhibits that promote learning in the absence of a facilitator or expert. Through iterative design of a multimedia exhibit and microanalysis of how groups mediate their collective understanding, I am working to develop a theory of collaborative learning in the informal setting and a set of principles to aid developers in the design process.

Learning that Transfers Across Multiple Settings: A Problem of Studying and Facilitating Nomadic Inquiry

Sherry Hsi, The Exploratorium

An on-going challenge faced by formal and informal science educators alike is the issue of knowledge integration and learning transfer across multiple settings. Regardless of whether learning takes place in a setting such as a science museum, school classroom, or outdoor nature area, effective inquiry-based science learning and teaching require careful attention to the physical space, well-designed instructional resources, and highly skilled facilitators who know when and how to offer guidance. Our educational hope is that learners will integrate disparate ideas and experience across these multiple contexts into a coherent understanding. I report upon design

studies conducted at the Exploratorium with a wireless handheld application designed to support 'nomadic inquiry' for visitors and museum educators. As a nomadic inquirer, the learner travels through physical and information landscapes, observes, asks personally-relevant questions, and seeks explanations. Based upon this application, I describe one model of an informal learner with an eye towards advancing our overall understanding of design for continuous learning.

References

Allen, S. (2002). Chapter 8: Looking for learning in visitor talk: A methodological exploration. In G. Leinhardt (Ed.), Learning Conversations in Museums (pp. 259-303): The Type House.

Bartels, D., & Hein, G. (2003). Book review: Learning in settings other than schools. *Educational Researcher* (August), 38-43.

Borun, M., Chambers, M. B., Dritsas, J., & Johnson, J. I. (1997). Enhancing family learning through exhibits. *Curator*, 40/4, 279-295.

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning Sciences*, 2(2), 141-178.

Callanan, M., and Jipson, J. Explanatory conversations and young children's developing scientific literacy. In K. Crowley, C. Schunn, and T. Okada (Eds.), *Designing for Science: Implications from Everyday, Classroom and Professional Settings*, Mahwah, NJ: Erlbaum, 2001.

Center for Informal Learning and Schools – http:/www.exploratorium.edu/cils

Cobb, P., Confrey, J., diSessa, A. A., Lehrer, R., & Schauble, L. (2003). Design experiements in educational research. Educational Researcher, 32(1), 9-13.

Collins, A., Bielaczyc, K., & Joseph, D. (2000). Design research: Theoretical and methodological issues. In J. C. Campione (Ed.), Volume in honor of Ann Brown.

Crowley, K., Callanan, M. A., Jipson, J., Galco, J., Topping, K., & Shrager, J. (2001). Shared scientific thinking in everyday parent-child activity. *Science Education*, 85(6), 712-732.

DBRC The Design-Based Research Collective (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher*, 32(1), 5-8.

Diamond, J. (1986). The behavior of family groups in science museums. Curator, 29/2, 139-154.

Dierking, L., & Falk, J. (1994). Family behavior and learning in informal science settings: A review of the research. *Science Education*, 78(1), 57-72.

Dierking, L. D., Falk, J. H., Rennie, L. J., Anderson, D., & Ellenbogen, K. (2003). Policy statement of the "Informal Science Education" ad hoc committee. *Journal of Research in Science Teaching*, 40(2).

Falk, J. H., & Dierking, L. D. (1992). The museum experience. Washington, DC: Whalesback.

Falk, J. H., & Dierking, L. D. (2000). Learning from Museums. Walnut Creek: AltaMira Press.

Hein, G. (1998). Learning in the museum. London ; New York: Routledge.

Hofstein, A., & Rosenfeld, S. (1996). Bridging the gap between formal and informal science learning. *Studies in Science Education*, 28, 87-112.

Leinhardt, G. Crowley, K. & Knutson, K., Eds. (2002). Learning Conversations in Museums. Lawrence Erlbaum Associates, Publishers.

Martin, L. (in press) An Emerging Research Framework for Studying Informal Learning and Schools. *Science Education.*

Museum Learning Collaborative – http://museumlearning.com/default.html

Paris, S. (1997). Situated motivation and informal learning. *Journal of Museum Education*, 22(2, 3), 22-27.

Ramey-Gassert, L., Walberg, H. J. I., & Walberg, H. J. (1994). Reexamining connections: Museums as science learning environments. Science Education, 78(4), 345-363.

Schauble, L., & Bartlett, K. (1997). Constructing a science gallery for children and families: The role of research in an innovative design process. Science Education, 81(6), 781-793.

Schauble, L., Leinhardt, G., & Martin, L. (1997). A framework for organizing a cumulative research agenda in informal learning contexts. *Journal of Museum Education*, 22(2 & 3), 3-8.

Wellington, J. (1990). Formal and informal learning in science: The role of the interactive science centres. *Physics Education*, 25, 247-252.

Wertsch, J. (2002). Epistemological issues about objects. In S. G. Paris (Ed.), Perspectives on object-centered learning in museums. Mahwah, N.J.: L. Erlbaum Associates.