SUGGESTED READING LIST
CENTER FOR INFORMAL LEARNING AND SCHOOLS (CILS)

PART ONE: INTRODUCTORY READINGS

These readings provide an introduction to key ideas related to learning theory, inquiry, museum—based learning, classroom-based science inquiry, and school organizational issues.

LEARNING THEORY

National Research Council (2000). How People Learn: Brain, Mind, Experience, and School. J.D. Bransford, A.L. Brown, & R.R. Cocking, (Eds.). Commission on Behavioral and Social Sciences and Education, Committee on Developments in the Science of Learning. Washington, DC: National Academy Press.

How People Learn is a book produced by the National Research Council (NRC) With a single focus: incorporating research findings from advances in cognitive science into the work of shaping effective learning environments and contexts. The original volume, published in 1999, was a product of a two-year study conducted by the NRC's Commission on Behavioral and Social Sciences and Education.

Scientific research of the past 30 years has provided us with a better understanding of memory, the structure of knowledge, problem solving, reasoning, the foundations of learning, the processes that regulate learning, learners' metacognition, and the influence of a learner's culture and community on their symbolic thinking. The Commission argues that education must be based on this research if it is to help students make sense of their surroundings and to prepare them for the challenges of the technology-driven, internationally competitive world.

How People Learn draws on numerous research findings and provides concrete examples to suppo1t the committee's assertion that learning is influenced fundamentally by the context in which it takes place, an assertion that is central to the work of CILS. The book also shows how decisions made at each stage in the shaping of learning contexts would be more effective if they were based on scientific research. To improve learning opportunities for all learners, the book provides seven recommendations that are well aligned with the CILS research agenda. Particularly relevant are the following five recommendations, paraphrased from the original text:

- Build local and global communities of teachers, administrators, students, parents, and others interested in learning.

- Expand opportunities for teachers' learning.
- Build learning environments that include tools of technology
- Provide "scaffolding" support, such as scientific visualization and model-based learning.
- Increase opportunities for learners to receive feedback, to engage in reflection on their own learning processes, and to receive guidance toward progressive revisions that improve their learning and reasoning.

The final two sections of *How People Learn* include extensive references divided by chapter and biographies of all committee and general staff members. The references illustrate the range of research informing the current state of the learning sciences, while the biographies illustrate the range of expertise represented on the committee. Both draw from the professional communities of K-12 teaching, psychology, learning research, teacher education, behavioral and cognitive sciences, natural and physical sciences, anthropology, and policy.

Dewey, J. (1938). *Experience and Education*. New York, NY: Touchstone Simon & Schuster.

John Dewey is considered by many to be the most influential theorist of education and philosopher of democracy of the twentieth century, as well as the original advocate for inquiry-based education. Dewey wrote Experience and Education twenty years after writing Democracy and Education, a book that helped to spawn the progressive education movement. In Experience and Education, Dewey describes how he reformulated some of his theories over the two decades that passed between these two books.

A staple of most teacher education programs' canon, Experience and Education is Dewey's most concise and final statement of his theories of education. In it, he analyzes "traditional" versus "progressive" education and addresses the criticisms his previous theories received. Directly relevant to the work of CILS is Dewey's philosophy of education, as it is represented in this book. The philosophy is one that respects all sources of a learner's experience and suggests creating learning environments that are social, dynamic, and learner-driven, while still being well choreographed and orderly. For example, in the fourth of eight chapters (on p. 58), Dewey asserts that planning such learning environments involves being "flexible enough to permit free play for individuality of experience and yet firm enough to give direction towards continuous development of power." These assertions are foundations of inquiry-based education and informal learning.

The central focus of Dewey's philosophical interests throughout his career would traditionally be described as "epistemology" or the "theory of knowledge." However, Dewey himself expressly rejected the term "epistemology" preferring instead to use "theory of inquiry" or "experimental logic" to describe his focus.

For more information on John Dewey, see the Center for Dewey Studies:
http://WWW.siu.edu/~dewevctr/index.htm

MUSEUM-BASED LEARNING

Falk, J. and Dierking, L. (1992). *The Museum Experience*. Washington, D.C.: Whalesback Books.

In *The Museum Experience*, Falk and Dierking portray the museum visit from the perspective of the visitor. This book is relevant to the work of CILS for many reasons. In it, Falk and Dierking review and synthesize several modern learning theories and research from science centers, zoos, and museums around the globe, and integrate findings from their own original research to give a thorough introduction to what is known about: Why people go to museums, what people do at museums, what people learn at museums, etc. It also offers recommendations and guidelines to help museum staff understand their clientele and their interactions with them.

The authors intended for the book to be provocative and to encourage discussion and debate. Falk and Dierking suggest using the term "free choice learning" as an alternative to using the phrase "informal learning," echoing the concerns of some CILS community members who feel "informal learning" is too broad a construct. The authors provide a new model for understanding and framing the museum experience, called the Interactive Experience Model, which connects personal, sociocultural, and physical contexts together, which is one of the goals of CILS. Falk and Dierking discuss the associative, obj ect-based learning that takes place in museums, provide concrete examples, and relate this kind of learning to the sometimes-formal characteristics of exhibitions themselves. They then suggest that museums need to rethink how they plan exhibits, publicize and promote museums and exhibits, and, especially, how museums orient visitors.

The extensive footnotes serve as a helpful annotated bibliography for those interested in the field of museum studies.

Hein, G. E. (1998). *Learning in the Museum*. In Museum Meanings series. London: Routledge Press

Recognizing museums' potential to provide extended learning opportunities, George Hein's *Learning in the Museum* serves as a practical guide, and describes how, by applying the findings of learning research and museum visitor studies, museums can facilitate a meaningful or influential educational experiences.

Hein is Professor Emeritus at Lesley University Graduate School of Arts and Social Sciences and for over 35 years has had extensive experience in museum education, science education, and curriculum development. He is familiar to many CILS community members for developing qualitative evaluation systems for museum programs, as well as mathematics and science education programs. Hein has also worked directly with several fellow CILS colleagues through his positions as Fulbright Research Fellow at King's College London (1990) and Osher Fellow at The Exploratorium in San Francisco (1999), to name just two. He serves on the advisory boards for several science museums and is a trustee of TERC.

First, *Learning* draws on the educational theory of Dewey, Vygotsky, and Piaget, and provides a theoretical basis for learning in the context of the museum. In chapter 2, Hein reviews different learning theories and their influence on designing educational artifacts and environments. The core (chapters three through six) of the book's eight chapters describes the methodology, the theories that inform, and some findings from museum visitor studies. In chapter five, Hein encourages researchers to apply network theories, as opposed to linear theories, to describe the learning process of visitors in museums. Chapter 7 discusses potential forms of evidence of learning in the museum. In chapter 8, Hein concludes that people learn best when they actively construct knowledge in physically and intellectually accessible environments and advocates the "constructivist" museum. Hein's personalized endnotes are an informative overview of the history and seminal work in museum education, and are included immediately before the references section and index.

Hein's focus on the interwoven, networked, and mutually influential nature of learning environments and experiences is highly relevant to the goals and Work of CILS, and makes the book an appropriate companion to Falk and Dierking's (2000) book, also a CILS suggested reading.

CLASSROOM SCIENCE

Minstrell, J. & van Zee, E. (Eds.) (2000). *Inquiring into Inquiry Learning and Teaching in Science*. Washington, DC: American Association for the Advancement of Science (AAAS).

This paper serves as the introduction to an edited book on inquiry teaching and learning in science. It begins by commenting on how inquiry is defined and recognized, and what the main components of inquiry learning are, including student-motivated learning, reasoning from observation and experiences, and reflection. A central point of the paper is that the goals of any inquiry lesson include addressing science content and the process of inquiry itself, and that while both goals are important, they cannot be focused on simultaneously. The authors argue that learning science content *through* inquiry allows learners to gain a deeper understanding of the science content, feel increased ownership for the material, and build their scientific skills.

The paper concludes with a vignette describing an inquiry lesson in the authors' class on Newton's Laws of Motion, which illustrates how both goals can be part of an inquiry lesson, and certain parts of the lesson can focus on content, while other parts focus on process.

National Science Foundation. (1999) *Inquiry: Thoughts, views, and strategies for the K-5 classroom.* In Foundations series (vol 2). Arlington, VA: NSF

This is the second volume in the National Science Foundation's (NSF's) monograph series entitled *Foundations*. Each *Foundations* volume presents the perspectives and lessons learned by individuals whose projects received grant support through NSF 's Division of Elementary, Secondary, and Informal Education (ESIE). The goal of the series is to disseminate improvement strategies for science, technology, and mathematics (STEM) education.

Inquiry is a collection of pieces written by core members of the CILS community, who at the time of writing were researchers, directors, advisors, designers, and program staff for the Institute for Inquiry (IFI). IFI is a professional development program for educators, including teachers, administrators, and professional developers, based at the Exploratorium in San Francisco, California.

All thirteen chapters of *Inquiry* are directly relevant to the work of CILS and are designed to serve as discussion pieces for others designing and implementing inquiry-based science education reform efforts. The chapters address a range of topics including the philosophy and benefits of inquiry learning, the relationship between inquiry and the National Science Education Standards (N SES), practical examples of inquiry in action, suggestions for recognizing what is inquiry and was is not, and assessment in the inquiry classroom. Chapter 5, "Lessons Learned: Addressing Common Misconceptions About Inquiry," could be a useful tool for responding to the concerns about and opposition to inquiry learning in that it describes how carefully designed and deliberately planned inquiry experiences might be to achieve learning goals. The Appendix to *Inquiry* provides useful background information on the authors and a compilation of recommended resources for more information on inquiry, including books, videos, and websites.

Driver, R., Leach, J ., Millar, R., & Scott, P. (1996). *Young People 's Images of Science*. Buckingham, UK: Open University Press.

This book describes the design and findings of a research project titled "The Development of Pupils' understanding of the Nature of Science," the purpose of which was to investigate the nature of K-12 students' understandings of the nature of science. The findings of the study suggest potential areas for the work of CILS to influence the work of K-12 science educators. The first two chapters of the book argue for giving the nature of science a more prominent place in school science curricula, and to support students' understandings of the work of scientists and the nature of scientific enterprise, in general. Chapter three reviews the major strands of the nature of science that this study was built upon. They are: 21) students' views about the purposes of scientific work; b) students' understandings of the nature and status of scientific knowledge and c) students' understandings of science as a social enterprise. A review of the literature, presented in chapter 4, suggests that students have an inductive view of science, do not differentiate between science and technology, have naive interpretations of scientific theories and their relation to evidence, and view scientists as individuals who work to produce artifacts that will be of benefit to mankind. In chapter 5, the authors describe the methods of their study: they designed a cross-age study and gave the same task to samples of students ages 9, 12, and 16. Raw data were the products of interviews usually done with pairs of students.

Chapters 6-9 are devoted to presenting and discussing the main findings of the study and chapter 10 discusses the implications of those findings. The findings of this study illustrated that students saw the purpose of science as one of addressing questions relating to physical and biological phenomena but not social phenomena. Moreover, it became evident through this study that for the most part, students held limited and stereotypical views of scientists, and that older students held beneficent view of scientists as people who work on important problems. The results of this study also showed that students held different views of scientific inquiry, ranging from scientific

inquiry is a process of making observations about the world, to scientific inquiry is about making generalizations from observations, to scientific inquiry involves the testing of models or theories. According to the authors, the most commonly held view about scientific inquiry amongst students was the second one (making generalizations from observations about the world), while the latter one (testing models or theories) was not commonly held, even by 16 year old students. Evidence from this study suggested that students did not view science as a social enterprise; instead, they viewed individual scientists working in isolation. The implications of these findings are associated with the ways in which science is presented in the curriculum and taught in the school classroom. More specifically, the implications of this study call for portraying science in schools in a more rounded and authentic way, and presenting science as a human endeavor that recognizes its limitations, as well as its achievements.

SCHOOL ORGANIZATIONAL ISSUES

Ogawa, R., Crowson, R., & Goldring, E. (1999). Enduring dilemmas of school organization. In J. Murphy and K. Louis (Eds.) ***Handbook of research on educational administration, second edition*****. San Francisco, CA: Jossey-Bass.**

This chapter explores what the authors consider to be an intrinsic feature of schools as organizations: the existence of "enduring dilemmas," or irresolvable dichotomies. The authors describe seven dilemmas in theoretical and empirical ways to illustrate this key property of organizations. Four of these dilemmas concern social work and relations: (1) the dilemma of goals (organization vs. individual interests), (2) the dilemma of task structures (formal vs. informal), (3) the dilemma of professionalism (bureaucratic vs. professional controls) and (4) the dilemma of hierarchy (centralization vs. decentralization). The remaining three dilemmas focus on environmental relations: (1) the dilemma of persistence (certainty vs. adaptability), (2) the dilemma of boundaries (internal management vs. community interactions) and (3) the dilemma of compliance (technical vs. institutional). In view of this essential and irreconcilably dual characteristic of school organizations, the authors conclude that those people developing educational reform efforts should aim to understand the implications and consequences of the choices they make when faced with such duality.

Rowan, B. (2002). The ecology of school improvement. ***Journal of Educational Change*****, 3: 283-314.**

This paper approaches the difficulties found by educational reform in the United States from a new theoretical perspective. Aside from school organization and government policies, it focuses on the school improvement "industry": a group of organizations that provides schools and governing agencies with information, training, materials and programmatic resources relevant to instructional improvement. These organizations include: (a) for-profit firms such as textbook publishers, school management organizations and instructional programs providers, which operate as suppliers and contractors to schools; (b) membership-based associations, which

provide information through specialized education periodicals and training to their members; and (c) nonprofit organizations, mostly funded by grants, that provide a wide variety of "products" such as educational research, technical assistance, information and advocacy to the K-12 education sector. Rowan analyzes how the school improvement industry operates an organizational ecology perspective, where the market forces acting upon the described organizations lead to competition for different "niches" or resources. The survival strategies that the organizations present are compared to ecological K- or r-strategies, where organizations are slow in change, uniform and stable, or actively changing, diverse and unstable, respectively. The very nature of these strategies offers an explanation to the peculiar pattern of educational change in the United States: the innovation created by rstrategists (membership associations and non-profit organizations) fades when confronted with the stable features of instruction of K-strategists (especially the nation-wide textbook publishers). Thus, the economic forces operating on this industry lead to the inalterability of the American education. Understanding this market is essential to develop new policies directed to school improvement in the United States.

PART TWO: KEY PAPERS

T he following list of readings contains key perspectives that inform the design and implementation of CILS research and leadership programs. The list was compiled on the assumption that the readers have some familiarity with developmental theory, experimental methods, classroom research, and current issues in educational reform.

Ash, D. (2003). Dialogic inquiry of family groups in a science museum. *Journal of Research in Science Teaching*, 40 (2). 138-162.

In this paper, Ash draws on sociocultural theory to propose a new research approach for collecting and analyzing family conversational data as it occurs naturally in informal educational settings like museums. The approach Ash advocates applies the multiple zones of proximal development of knowledge and focuses on the use of dialogic inquiry as a way to co-construct meaning. The units of analysis in this approach are fragments of conversations called "representative dialogic segments" (RDS), which Ash suggests reflect larger patterns of interaction. To illustrate the proposed methodology, she analyzes, in detail, three different RDSs that were obtained in a biology exhibit in a science museum. In her analysis, Ash focuses on two components of the dialogic inquiry: theme content, which is provided by the interaction between the exhibit and the families' agenda, and inquiry skills, such as observing, questioning, interpreting, etc. Ash concludes that the use of this method and theoretical framework is a new research tool suitable for a variety of research aims.

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

Influential psychologist Ann Brown was based at the University of California, Berkeley when she wrote this article. Brown was noted for her substantial research on learning and learning situations, particularly those that occur in the classroom. Several members of the CILS community collaborated and co-authored papers with her.

This particular article is also relevant to the work of CILS' researchers because in it, Brown reveals some of the methodological challenges she encountered while conducting her own design experiments in classrooms and she makes suggestions for how to address similar challenges. Brown defines design experiments as attempts to engineer a working environment amid a complex set of interacting features.

Brown outlines three major methodological issues facing researchers attempting to assess conceptual change in a complex environment such as a classroom: the relationship between laboratory and classroom work; idiographic versus nomothetic approaches (grain size issue); and the Bartlett Effect. Brown concludes the article by discussing what can be learned from well~known design experiments.

Crowley, K., Callanan, M., Tenenbaum, H., & Allen E. (2001). Parents explain more often to boys than to girls during shared scientific thinking. *Psychological Science*, 12 (3). 258-261.

This is a report on a research study that investigated whether parents at a children's museum offered scientific explanations to their children differently, depending on whether their children were boys or girls. The researchers, who included Maureen Callanan from UCSC, an active member of and contributor to CILS — videotaped interactions between parents and their children at different exhibits. The researchers then coded the interactions, based on whether the parents gave their children a scientific explanation for what they were observing, such as drawing a causal connection between what the child was doing and the exhibit display. The researchers found that when an exhibit did not require explanation, parents spoke with essentially the same frequency and in essentially the same way to both boys and girls. But if an exhibit did require explanation, parents were three times more likely to offer scientific explanations to boys that to girls.

This report discusses the findings of this study, in terms of how they might help to explain the gender gap in children's interest and achievement in science, and the importance of museums recognizing these gender differences so they can work on ways to address them.

Duensing, S. (2003). Culture matters: Informal science centers and cultural contexts. *Learning in Places: The Informal Education Reader* (in press), Peter Lang Publishers.

Duensing argues that, like universities and K-12 schools, informal education institutions are extensions of the cultures in which they usually exist. This article discusses the different ways in which exhibits and programs have been adapted by exhibit designers and museum educators in

science centers around the world. The article is based on experiences that Duensing had when she helped to export Exploratorium exhibits internationally and focuses specifically on her work at Yapollo, the national science center of the West Indes. The author suggests that science center presentations, exhibit designs, and styles of learning are rooted in the cultural contexts in which such informal learning institutions are located. According to Duensing, the cultural experiences of the museum staff also have a substantial impact on the practices of the museum at large. The findings of this study offer useful ideas for understanding how a science museum can best serve its intended audience. This work also demonstrates how difficult it can be to precisely define informal education.

Moll, L. & Greenberg, J. (1990). Creating zones of possibilities: Combining social contexts for instruction. In L. Moll (Ed.), ***Vygotsky and Education: Instructional Implications and Applications of Sociohistorical*** **Psychology (pp. 319-348). Cambridge, UK: Cambridge University Press.**

This paper describes three studies that were included in a research project about community-based knowledge and its potential use in after-school and classroom instruction. The project was conducted within a Hispanic community located in Tucson, Arizona. The first study of the project was to document the history and exchange of domains of knowledge (e. g., agriculture, automobile repair) among households in a complex social system, and labeled the result the community's "funds of knowledge." The second study looked at an after-school lab where the researchers collaborated with teachers to create writing modules that utilized the studentsI social networks of knowledge. The third study focused on a teacher who took one of the modules from the after-school lab, brought it into her classroom and extended it to tap into the community's funds of knowledge. She brought in community members and made them participants in the classroom activities, as well. Throughout the paper, the studies and the results are described in terms of Vygotskian theory and the importance of socially mediated resources for learning.

Moschkovich, J. (2002). Preface. In M. Brenner & J. Moshkovich (Eds.), ***Everyday and Academic Mathematics.*** **A monograph from the Journal for Research in Mathematics Education (Number 11, pp. 1-11).**

This paper addresses two apparently opposing recommendations for the appropriate focus of classroom curriculum and pedagogy in mathematics. The first is to use “everyday" mathematics, presenting mathematics in the context of solving real-world problems, such as the kind encountered daily at home and at work by non-mathematicians; for example, making change from a larger bill.

The second recommendation the paper addresses is using "academic" mathematics, which suggests presenting mathematics in contexts that resemble as closely as possible, the work of academic mathematicians; for example, constructing mathematical proofs.

Moschkovich discusses the view that everyday and academic mathematics are mutually exclusive from historical and sociological perspectives, and proposes that part of the reason the

two have been seen as dichotomous may be due to the lack of ethnographic studies documenting the daily practices of academic mathematicians. The author suggests that rather than choosing between these two goals, a better strategy would be to synthesize them by, for example, having students work on applied problems and then construct mathematical arguments for alternative solutions, thereby incorporating both the accessibility and motivational aspects of everyday mathematics and the specialized skills of academic mathematics that are important for higher education.

Oppenheimer, F. (1976). Everyone is you... or me. *Technology Review* (June), 31-35.

Oppenheimer, physicist, and founder of The Exploratorium, explains the experience that the Exploratorium seeks to provide, including offering visitors an unrushed tour of natural science, instead of the formalized goal-oriented teaching found in classrooms. Oppenheimer takes the readers on this unrushed tour, compares exhibits, and describes the links between exhibits, their multiplicity, and beauty along with their strengths and weaknesses. Oppenheimer elaborates on the affect this sort of tour has on cultivating "addicts" of individual discovery. He also speculates whether the cultivation of addicts of individual discovery simply occurs through particular exhibits, or whether it requires supplemental museum materials, such as literature or broadcast videos. Finally, Oppenheimer describes the general atmosphere within the museum as a free-form, noninstructive, and non-judgmental environment; critical characteristics for helping people feel comfortable pursuing their own understanding of nature.

Osborne, J., Collins, S., Rateliffe, M., Millar, R., & Duschl, R. (2002). What 'ideas about scienee' should be taught in school science? A Delphi study of the expert community. *Journal of the Research of Science Teaching, 40(7), 692-720.*

This is a report on a small-scale empirical study about participant views on the nature of science using a Delphi study approach. The empirical study asked, "What should be taught to school students about the nature of science?" Twenty-three participants were drawn from a community of scientists, historians, philosophers, and sociologists, expert science teachers, and experts who work in improving public understanding of science. The outcomes of the study are nine themes encapsulating key ideas about the nature of science for which there was consensus. These themes, described as simplified accounts of science, are suggested as an essential component of school science.

The paper begins with a historical account of the debates and disagreements in science education about the nature of science: whether science is socially constructed or objective, whether nature of science should be taught and if so, to whom (all learners or future scientists), which aspects. Science education fails because it does not adequately communicate the nature, practices, and processes of science, thus leaving kids with limited views and disinterest in sciences. The paper speculates that current documents created by National Science Education Standards, Benchmarks for Science Literacy, and others are a product of compromises made by committees rather than a coherent account of the nature of science. The author also contrasts their study to Alters (1997) student of 210 members of the US Philosophy of Science Association, which found there Was no

agreement on philosophies of science and that members held 11 different fundamental philosophies of science positions. These helped to motivate the study at hand.

The Delphi study was accomplished in three rounds. The first was an open-ended brainstorm asking three focusing questions that generated 30 themes (with >80% reliability) categorized under three themes: Nature of Scientific Knowledge, the Institutions and Social Practices of Science, and the Methods of Science. In the second round, these statements were rated on a 5-point Likert scale for their importance to compulsory school science curriculum, resulting in 8 top themes, the top three being Experimental Method and Critical testing, the Tentative Nature of Scientific Knowledge, and the Historical Development of Scientific Knowledge. In last phase, researchers decided to take the top rated themes (18) from round 2 and have experts rate them again. Finally, 9 themes emerged which there was both consensus and stability.

They go on to discuss the paper with respect to curriculum, science instruction, and implementation. The authors believe that while they run the risk of misrepresenting the essential elements of scientific practice and the values of the scientific community when they teach this simplified “vulgarized account” of science, the study can still provide a basic understanding of the processes and practices of science and of the nature of knowledge produced in the process. This is groundwork for the more sophisticated accounts of science that may develop later in life.

Rogoff, B., Paradise, R., Mejia Arauz, R., Correa-Chavez, M., & Angelillo, C. (2003). Firsthand learning by intent participation. ***Annual Review of Psychology*****, 54, 175-203.**

In this article, the authors describe the learning tradition of "intent participation," where the learner obtains knowledge through active observation and "listening-in" during the course of ongoing and shared activities. The authors contrast intent participation with the type of instruction typically found in Western schools, which they call "assembly-line instruction," where knowledge is transmitted from the teacher to the student in small pieces, out of the context of "real world" work. Intent participation is shown to be particularly emphasized and valued in cultures where children are expected to take part in community activities at an early age. The authors outline the differences between intent participation and assembly-line instruction, in terms of who participates and how, the processes of instruction and learning, the roles of experts and novices, and the motivation and purpose behind the learning and the role of assessment.

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.**

In this paper, the authors introduce a theoretical framework for coordinating research on informal learning contexts that was developed to organize and catalyze the research agenda of the Museum Learning Collaborative (MLC). To start, the authors review what is known about the nature of informal learning and describe the difficulties educational researchers encounter in the informal context. To inform their theoretical framework for research, the authors draw primarily on sociocultural theory, which asserts that the meaning of an experience emerges from the interplay between individuals and the mediators employed in social contexts. The variability of

learning, the processes of learning, the role of learning in personal history, and the pursuit of meaning are all features with which sociocultural theory is concerned.

The authors articulate three major themes that constitute the framework: (1) learning and learning environments; (2) interpretations, meaning and explanation; and (3) identity, motivation and interest. These themes are explained and illustrated with specific and concrete examples of learning research conducted in informal learning environment. The theme of learning and learning environments focuses on how learning environments or contexts should be designed so as to best support learning. The interpretation, meaning, and explanation theme considers these aspects as both processes and products of social interaction in museums. The identity, motivation, and interest theme emphasizes that the personal learning experiences of people in museums both depend on and change how people see themselves. The formulation and pursuit of this agenda aims to bring together research, theory, and practical problems of informal learning to work toward a cumulative and comprehensive knowledge base.

Scribner, S. & Cole, M. (1973). Cognitive consequences of formal and informal education. *Science, 182*(4112), 553-559.

The central question the authors address in this article is whether differences in the social organization of education lead to differences in the organization of learning and thinking skills in individuals: does formal schooling produce differences in the problem-solving techniques used by the person who goes through it? The authors review the research and evidence (as of 1973), and claim that formal education fundamentally changes the way people approach problems, compared to people who have no formal education. In a study of Senegalese villagers, the researchers found that the villagers with even a few years of formal schooling had very different approaches to problem solving than their more informally educated peers and they used a variety of strategies to solve a variety of problems, as compared to their more informally educated peers. What is the significance of the differences in the organization of thinking and learning that are seen in those With formal education as compared to those without it? Are these differences useful in every cultural setting, or does formal education impede the participation of individuals in the everyday life of their communities? These are a few of the questions raised as potential implications and future research questions for the field.

vom Lehn, D., Heath, C., & Hindmarsh, J. (2001). Exhibiting interaction: Conduct and collaboration in museums and galleries. *Symbolic Interaction, Official journal of the Society for the Study of Symbolic Interaction, 24(2),* 189-216.

Most studies of visitor behavior in museums and galleries focus on a single visitor interacting with a single exhibit. The nature of the visitor's interaction with the exhibit, along With the meaning the visitor drew from it, are assumed to be due primarily to the exhibit's design and layout. However, as this article demonstrates, a visitor's experience of an exhibit is also greatly affected by the social environment and the relationship between the exhibit and other objects within the physical space. The other exhibits encountered before and after, the behavior of the visitor's companions and the behavior of strangers within proximity all have strong effects on

how the visitor engages With, and draws meaning from, the exhibit. The authors advocate the use of videotape along with field observations as a method for evaluating important social, non-verbal, and sequential aspects of visitor behavior, and they present several video fragments from their own work, as examples of their findings. The authors summarize their contribution to the field of symbolic interactionism, as Well as their implications for museum exhibit design and visitor studies.