Mapping the learning pathways and processes associated with the development of expertise and learner identities

Abstract: This poster session showcases ten examples of expertise development in everyday domains of personal relevance and consequence to learners. The collection of cases highlighted in the posters stem from ethnographic research studies investigating learning from socio-cultural-historical perspectives. In each poster, authors describe their ethnographic project, explicate a case of expertise development, and detail the specific learning processes, practices, and pathways associated with that expertise development. Implications for understanding personally relevant and consequential learning for the design of effective learning environments in K-12 STEM classrooms and beyond will be discussed. Discussion will also include plans for the design and implementation of a data repository, which will house a broad set of learning cases, such as those detailed in this poster session, with the goals of supporting collaborative theoretical synthesizing related to diverse learning-related phenomena and helping researchers and educators understand the details of learning as it socially occurs in meaningful ways.

Conceptualizing Expertise

How we conceptualize, document, and support the development of specific areas of expertise is a fundamental aspect of "cre8ing a learning world," as the conference theme challenges us to do. Before designing effective learning environments in so-called formal (e.g., schools) and informal (e.g., museums) environments, we argue that we need to map the learning processes, practices, and domains people utilize when they develop areas of expertise in their everyday lives. We know very little about how learning and expertise develop over time scales based on a breadth of idiosyncratic human experience in the social settings people routinely frequent (Bell, et al., 2006). Through the use of an interactive poster session, we engage in this scientific agenda by presenting a range of learning cases from ethnographic research studies.

By design, the posters presented in this session highlight expertise development and the navigation of learning pathways in social contexts other than the traditional school day and from domains that are personally consequential and meaningful to the learners (although possibly not common in school). We argue that delineating specific learning processes associated with expertise development in these contexts and domains is crucial for understanding consequential learning and may inform the design of effective learning environments in K-12 STEM classrooms and beyond. In describing the proposed interactive poster session, a brief review of the expertise literature is followed by individual poster descriptions—including the core learning practices and processes showcased relative to the highlighted areas of expertise.

Situating Expertise

Most of the expertise literature emphasizes the practices of individual people who already hold the title of "expert," such as chess masters and surgeons (e.g., Norman, Eva, Brooks, and Hamstra, 2006). Expert knowledge, competencies, and performances are often pitted against those of novices in an attempt to determine exactly what makes someone an expert versus someone who is attempting to reach expert status or knows little about the domain in question. A growing body of literature discusses the development of expertise (e.g., Ericsson, Charness, Feltovich & Hoffman, 2006) from a variety of theoretical (e.g., psychological, sociological) and methodological (e.g., laboratory, historiometric, psychometric, and ethnographic studies) perspectives. A central focus of the traditional expertise program of research has been to delineate individual expert knowledge, competencies, and performances in various domains, study the mental structures and organization of expert knowledge and related constructs such as efficiency of expert knowledge and the ability of experts to innovate within their domain of expertise, and examine issues related to generalizability of expert knowledge, such as the reproduction of expert performances within and across domains.

Scholars from disciplines such as sociology (e.g., Collins and Evans, 2007), philosophy (e.g., Selinger and Crease, 2006), psychology (e.g., Hakkarainen, Polonen, Paavola, and Lehtinen, 2004), cognitive science (e.g., Hutchins, 1995), and the learning sciences (e.g., Bell, et al., 2006) have been rethinking the notion of expertise as mentalist and individualist; focusing instead on its social, cultural, and historical influences. Hakkarainen et al. (2004) highlight "…the emphasis on the role of cultural-historically developed tools and artifacts in human intelligent activity, and the examination of intelligent activity as embedded in social and cultural environments" (p. 6) as a central element of this alternative view of expertise. Collins and Evans (2007) note that expertise is not simply attributed by members of a given group, which would imply that no real work is done by those who are deemed expert because "all the work is done by the attributors" (p. 3). Instead expertise is represented by: "the real and substantive possession of groups of experts and that individuals acquire real and

substantive expertise through their membership of those groups…expertise is, therefore, a social process – a matter of socialization into the practices of an expert group…" (p. 3).

Learning is therefore deeply bound up in an account of expertise development because one must learn what expertise means within the confines of the groups to which he/she belongs, learn what practices and other, possibly tacit, understandings are associated with that expertise, and learn which networks of people and resources are best able to socialize one into these practices and understandings. The posters in this interactive session situate themselves broadly in a socio-cultural-historical framework (e.g., Bruner, 1990; Cole, 1996; Lave and Wenger, 1991; Rogoff and Lave, 1984/1999) relative to the development of expertise and the learning pathways associated with that development by highlighting *specific, culturally rooted* learning processes and practices associated with expertise development and explicating how people utilize those processes and practices to participate in expertise development within areas and domains that are personally consequential to them for a variety of locally maintained reasons.

A Learning Cases Repository as Collaborative Infrastructure for the Learning Sciences

Unlike other social science fields, the learning sciences lacks a collective data repository housing a broad set of learning cases, rendered in theoretical and educational terms, which could be used to advance our scientific understanding and inform our professional development activities. Open source network technologies provide a unique platform for such repositories. The Learning in Informal and Formal Environments (LIFE) Center, a National Science Foundation funded Science of Learning Center in the U.S. is interested in developing a Learning Cases repository of this kind with scholars who share this interest. The long term goals would be to support a deeper sharing of interpreted cases of learning across a breadth of social contexts and domains, support our collective theoretical synthesis of learning-related phenomena, and develop a repository that would help researchers and educators understand the details of learning as it socially occurs in meaningful ways. It is our intention to unveil this collective data repository of Learning Cases during this ICLS session, using some of the work included in the session as an initial data corpus, and make it available for open use by learning scientists writ large. Details on this effort will be posted on the LIFE Center web site (http://life-slc.org/).

Poster Descriptions

Man of the match: Learning processes associated with becoming a soccer phenomenon

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This poster details the learning processes and practices associated with development of expertise in sport, specifically in the domain of soccer (cf, Hodges, Starkes, and MacMahon, 2006). We look at the composite contributions of practice, imitation, disciplined observation, collaboration, and critique in becoming a soccer phenomenon. We also examine the role of place (cf, Lave and Wenger, 1991) and border crossing (cf, Aikenhead, 1996; Lugones, 2003) relative to expertise development. We utilize data from ethnographic observations and interviews. Data sources include video- and audiotape, digital photographs, and fieldnotes. In this analysis, we utilize both etic and emic perspectives (Harris, 1987; Pike, 1954) on soccer expertise development. We argue that emic perspectives are critical to understanding expertise development yet they are rare in the expertise literature. This analysis is situated in a larger ethnographic project, which documents upper elementary and middle school students' everyday encounters with science and technology (Bell, Bricker, Lee, Reeve, Zimmerman, 2006).

Although the relationships between learning soccer and learning in science, technology, engineering, and mathematics (STEM) domains might not be readily apparent, we argue that (a) our participants do draw associations between the two arenas, (b) versions of practice, imitation, disciplined observation, collaboration, and critique are also utilized in the development of STEM expertise, and (c) issues of place and border crossing are of critical importance. We argue that to date, many of the STEM related learning environments designed by learning scientists do not deeply attend to the learning processes and practices associated with expertise development in domains of personal relevance and consequence to learners. Failure to do so is a missed opportunity to actively engage learners at best and at worst, could seriously undermine their opportunities to learn. After detailing the learning processes and practices associated with expertise development in one such personally relevant domain, we discuss implications for design.

Learning to videogame, both together and alone

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Many young people today spend significant amounts of time developing expertise in video and computer game play. Such games range widely in genre, structure, and required skills. A deeper understanding of everyday game learning pathways can both broaden our accounts of technology in learning and help us understand how young people pursue learning in domains that are personally significant.

The case described in this poster outlines how two boys (12 years and 11 years old, respectively) are developing expertise at a range of video and computer games. Data are drawn from a multi-year team ethnography of children in an urban, multicultural community and their everyday interactions with science and technology (Bell, et al., 2006). Methods used include observation, participant observation, and semi-structured interviews, with fieldwork extending over a period of 18 months in 2006-07.

For both children, learning to videogame has individual and social aspects tightly interwoven together. Explicit social interactions include finding out about from and sometimes playing games with peers or extended family members. They have also built extended social networks through their online game play, and ask questions of other players online when they encounter a snag in game play. In addition, however, they spend considerable amounts of time playing games on their own, and they say that they often learn about games just by playing and figuring them out. Family structures and homework routines also play into this pattern of solitary play.

One contrastive dimension of the two cases relates to the public recognition of the two boys' expertise. One of the boys is called on frequently by family members and friends to explicitly take on the role of an expert, leading not only to recognition of his expertise, but also to establishing and strengthening his expert role. These cases will more deeply investigate how children come to learn computer and video games, a domain that, because of its increasing prevalence in contemporary society and children's leisure time, is important for both educators and researchers to better understand.

Mapping the emergence and development of collaborative media production practices

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Digital technologies offer adolescents rich opportunities to design and create artwork, stories, games, animations, interactive robots, and other expressive or documentary artifacts. Surrounding these capacities are "cultures of participation" (Jenkins, 2006) where young people share their work, receive feedback, and expand their social networks. It has been suggested that participation in these informal collectives nurture the development of important 21st century capacities such as the capacity to collaborate, analyze information, and direct one's own learning. Although physical access to computing tools is becoming less of an issue, there are still stark differences among adolescents in terms of who has access to learning opportunities that will position them to develop expertise and identities as creators and accomplished learners.

Our research takes place in an environment intentionally designed to encourage creative media work by middle school students (Pinkard, Barron, Martin, Gomez, 2007). It provides access to design work with digital media including robotics, digital movie making, game design, and music. Mentors were recruited on the basis of their artistic expertise, personal portfolios of work, shared cultural history with the school community, and interest in new media technologies. We are following a cohort of 47 learners across two years of middle school. For twelve case study learners, we also construct technobiographies based on accounts provided in interviews and through observations in order to chart learning activities and resources across time and setting (Barron, 2006). The goal of constructing detailed learning histories is to better conceptualize learning processes that underlie expertise development. We focus on projects as a unit of analysis and for each project we track the number and roles of learning partners involved (Barron, Martin, Takeuchi, Fithian, in review), the duration of the project, the origins and evolution of the project, and the learning outcomes reflected in the product and process of creation. Field notes and video collected by researchers and teacher/mentors offer additional data.

We will present two cases that reveal learner's developing expertise in *collaborative new media production*. In each case, learners collaboratively created original music and lyrics and used semi-professional digital media tools to develop and record their work. We will share their expertise along three lines: 1) *repertoires of collaborative practices* as reflected in their projects and their capacity to explain phases of collaborative media production; 2) *growing identities* as authors, creators and critiquers; 3) *knowledge of the tools of production* and confidence in using them. Our research goal is to better understand learning processes and outcomes that arise from extended work with digital media projects in order to contribute to theories of learning and to advance our understanding of how to design programs that sustain learning and motivation.

Leet noobs: Expert *World of Warcraft* players relearning and adapting expertise in new contexts

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World of Warcraft (*WoW*), like many other massively multiplayer online games (MMOGs), can actually be seen as two different games. The first is the journey of exploring the game world and advancing the abilities of one's character or avatar either through solo play or in groups of up to five players. This acts as a proving grounds or gateway for the second stage of *WoW*—joining a raid group of up to 40 players to kill all the monsters in "high-end" or "endgame" dungeons for the treasures they guard. Within a larger online games ethnography (Chen, in review) similar to others that describe player practice and learning (Steinkuehler, 2007, and Taylor, 2006), I have found that invitation to join an end-game group is contingent on a player's reputation as an expert of *WoW*'s underlying mechanics and rules. It is also necessary, however, to have proven oneself as someone who works well with others and understands his or her particular role in a team. Upon joining a raid group, players soon find that the conditions that determine expertise have changed because the activities and player practices have changed to fit the local context, which includes raid-specific tactics and new communication norms. It becomes clear that expertise is specialized for individual roles, depending on character type, and that to succeed as a raid group, players need to draw on their distributed expertise and knowledge (Hutchins, 1995), each doing their part while trusting others to do the same, so that collectively they act as a coordinated whole. Yet the actual skills and abilities an individual player uses are reassessed for how well they complement other players' resources. Thus, once-expert players become novices or "noobs" to relearn expert or "leet" gameplay, yet they are not true novices because they already have a good understanding of the game system. Rather, they are leet noobs who must realign and adapt their expertise for new social structures and norms that emerge above the underlying game through joint venture. This poster highlights examples of learning individual expertise as well as new distributed expertise needed for raid group success.

The development of expertise in animal husbandry and behavior

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Caring for pets is a personally consequential activity for many youth. Children invest time, resources, and intellectual energies into developing knowledge and practices to ensure the healthy development and longevity of their pet. Understanding the learning processes and pathways that lead to pet care expertise will broaden accounts of everyday biological knowledge and the development of scientific practices. Additionally, by careful study of youth participating in activities that they consider highly meaningful, we can develop a set of design principles for crafting engaging learning environments.

In this poster, we present a case study of the individual, social, and cultural influences on one youth's animal expertise. We documented Penelope's work with animals over two years through video ethnography, fieldnotes, and a photo-documentation task. This analysis is part of a larger cross-setting ethnography of science and technology involving 9-13 year-old children in one urban, multicultural community in the northwestern USA. In this case, we focus on the development of Penelope's expertise with animals across social settings including home, community, school, and an afterschool club. Talk and practices related to animals were present at nearly every research visit with Penelope—especially related to the care of Penelope's hamsters. Penelope marks her own expertise with hamsters as illustrated when she created a how-to guide for hamster care. Through this how-to guide and multiple other interactions, Penelope showed the research team her multiple learning processes related to animal husbandry practices, including developing social networks, participating in a community of practice, using print and online resources, conducting observations of animal behavior, and trial and error experimentation with habitat elements. This case looks deeply at how Penelope developed her

expertise over time and across settings with implications for formal and informal educators interested in science learning.

Documenting the social factors that support youth's identities as environmental change agents

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Environmental education is failing to reach traditionally underrepresented groups of people even though statistics show that these youth and their families disproportionately live in urban areas in which environmental issues affect their daily lives (Lewis & James, 1995; Agyemon, 2003). One reason for this may be that environmentalism and the design of environmental education have largely been the arena of white middle class people who have narrowly defined "environment" in a way that has not included issues relevant to urban settings (Taylor, 1996). In this poster, we explore the development of environmental stewardship and activism in youth from populations that are underrepresented in STEM. We explore the social factors involved in the development of identities as what we are calling "environmental change agents", or people who can promote social change through environmental action, and link this identity development to the intersection of ethnic, class, gender, and academic identities within the youth themselves. Another way we try to understand this identity development is by drawing on literature in critical place-base education (Barton, 2001, Gruenwald, 2003a & b) and exploring the ways in which youth gain expertise in understanding the relationship between physical places and class, ethnicity, and issues of environmental justice.

The findings presented in this poster are from a 12-month, cross-setting ethnographic study where we observe youth from two settings: an after-school program focused on environmental justice and fifth graders in an all-girls' school in which the curriculum is focused on environmental stewardship education. Youth from each of these settings were observed both in the more "formal" educational setting (after-school program or classroom) as well as in their homes and other everyday settings of their lives. Methods used included participant-observation, semi-structured interviews, and photo-documentation. In addition to critical place-based education, we draw on critical theory (Harding, 1991), multicultural science education (Cajete, 1994; Stanley and Brickhouse, 2001), and education for sustainability (Donehower, et al, 2007) to understand the various ways in which youth work within and against their social contexts for environmental change.

Whose expertise?: Students in the rural Himalayas and their encounters with school and indigenous knowledge of sustainability and place

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Environmental education is generally thought of as formal education on environmental science topics. However, our work with rural villages in the Himalayas shows a disconnect between formal science learning in schools and students' environmental learning needs. In particular, students require an understanding of the environment that is local, practical, and actionable, since environmental conditions are tightly linked to individual survival and livelihood. However, no one source of expertise provides this—students must reconcile normative, abstract school science, indigenous knowledge and practices, and detailed knowledge of local environmental systems, which are rapidly shifting and poorly documented. In this poster, we describe some of the locally invented solutions to provide the necessary environmental learning in the Kumaon region in northern India and in Nepal, and how schools, communities, nonprofits, and students configure themselves to build expertise. We use field observation (four field visits over one year), interviews, and documents to triangulate how three communities have developed ways to support environmental learning, and some of the strategies and systems used to unify different sources of expertise. These experiences suggest that a web-like rather than hierarchical or linear model of expertise can help students and others meet their learning needs.

Different strokes: Play, management, and collaboration as three approaches among parents to teaching their children how to handle money

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This poster reports on an ethnographic study called Money Matters, which investigates how families approach financial decisions in their everyday lives. Over 18-24 months, we video-recorded interviews and naturally occurring financial activities in the homes of eight families, each with a resident adolescent. Results suggest that learning to manage finances within these families is organized through varied practices and resources. Not only did financial realities differ across families, but so did perspectives of what it means to be financially successful and, thus, what construes expertise. Furthermore, parents across families were found to share their financial expertise in different ways with their adolescent children.

We describe three arrangements of expertise sharing —play, management, and collaboration —that parents employed when communicating financial practices with their children. For example, in the dual income, upper middle class Baker family, father Neil created game-like contexts for his four children to develop negotiation skills that he felt important for their future success. In other instances, we noted the children engaging similar playful bantering to negotiate payment for household chores. Karen, a single middle class mother, with one adolescent daughter, is a member of a 12-step support group for people in debt through which Karen has developed a routine to keep track of her finances. With her daughter, Karen tends to manage controlled practices by imposing spending plans and insisting that her daughter pay consequential expenses. We found that the Bakers' financial flexibility opened a space within which the children were allowed to play and explore financial responsibilities without the pressure of "failing" and serious consequence. In the families with fewer slack resources and who inhabited a different cultural relationship to money, the pressure to "succeed" or do it "right" was predominant and, we argue, limited their inclination and opportunity to explore. These class and resource-based differences and their link to distinct arrangements for becoming expert with money is our key finding, from which we also draw educational and design implications.

When do you ask a doctor? Parents of autistic children as expert users of scientific and medical expertise

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Science impinges on our lives in situations as diverse as political protest and personal health crisis (Epstein, 1996). During such times, scientific expertise alone is often insufficient to satisfy the socially situated needs of protesters or medical patients (Wynne, 1992). Confronted with science-related controversies or uncertain diagnoses, they must first figure out if scientific expertise is relevant—and if so, how (Layton, Jenkins, Mcgill and Davey, 1993). In this presentation, I examine how one group of laypeople—parents of young autistic children—become experienced, even expert users of scientific and medical expertise. Autism is a complex and controversial disorder. Its characteristic symptoms are well defined, but there is no consensus on its causes or treatment. Parents of autistic children are encouraged to pursue prompt intervention, but receive little guidance as to which of the bewildering array of options will be most effective.

My analysis draws on the findings of a longitudinal interview study in which parents from ten different families were followed for six months to discover which questions mattered most to them, and which resources they used to answer those questions. I deliberately juxtapose two different perspectives on expertise: that of cognitive psychology, in which expertise is viewed as an acquired characteristic of individuals, and that of sociology, in which expertise is viewed as a relational quality negotiated by groups. The psychological dimension of expertise is evident in the evolving sophistication of parents' questions – as they frame and re-frame their concerns, they learn which questions are most likely to get satisfying answers. The sociological dimension is revealed by parents' increasing ability to target questions to appropriate 'levels' of technical expert, and to combine multiple expert sources in their resource-gathering and decision-making processes. In other words, parents become experts at enacting and interpreting the complex and dynamic relationships between doctors, scientists and laypeople. In the process, they develop nuanced understandings of when and how scientific expertise is relevant to them, their children and their families.

Tailored learning in- and out-of-school: Towards an integrated process perspective

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This poster explores the nature of individual interests (Hidi, Renninger & Krapp, 2004)—which are known to cut across many of a person's practices—and the conditions under which students might successfully

bring their interests to classroom learning. Roughly, the premise is that we can begin "cre8ing a learning world" by affording people systematic opportunities to forge coherent experiences across sites of learning.

I draw on two distinct studies to theorize about processes underlying individuals' interest-based pursuits and the development of personally meaningful expertise. The first study is a 3-year-long, ethnographic, grounded theoretical investigation of model rocketeers plying their trade in multiple communities and sites of practice (Azevedo, 2004). Following the open-ended, self-motivated, self-guided nature of hobbies, I show that rocketeers develop multiple *preferences* (goals, values, beliefs, etc) in the practice and these preferences are variably attuned to constraints and affordances of practice. It is by differentially engaging these preferences throughout practice time that individuals develop a deeply meaningful and multifaceted relationship to the hobby.

The second study regards students' interest-based pursuits in computer-based, scientific image processing activities (Azevedo, 2006). Beginning with a large corpus of video records, I select episodes in which students appear to be highly engaged. Close inspection of these episodes show that students pursue proposed activities but sporadically and opportunistically "bend" such activities (say, by repurposing given computational tools). These activity "detours," which I call *personal excursions*, amount to whole new, student-initiated activities that bear important relationships to proposed activities.

With the basics laid out, I then highlight similarities across the processes' dynamics and dependencies. In particular, I show that truly interest-based pursuits imply a high degree of tailored activity, which leads to highly tailored learning and the development of pockets of distributed expertise.

References

Agyeman, J. (2003). "Under-participation" and ethnocentrism in environmental education research: Developing "culturally sensitive research approaches". *Canadian Journal of Environmental Education, 8*, pp. 80-94.

Aikenhead, G.S. (1996). Science education: Border crossing into the subculture of science. *Studies in Science Education, 27*, pp. 1-52.

Azevedo, F. S. (2004, June). What does it mean to be interested in a practice? Paper presented as part of the symposium *Design theories of interest, motivation, and engagement for the learning sciences*, International Conference of the Learning Sciences, Santa Monica.

Azevedo, F. S. (2006). Personal excursions: Investigating the dynamics of student engagement. *International Journal of Computers for Mathematical Learning*, *11*, 57-98.

Barron, B. (2006). Interest and self-sustained learning as catalysts of development: A learning ecologies perspective. *Human Development*, *49*, 193-224.

Barron, B., Martin, C.K., Takeuchi, L., & Fithian, R. (in review). Parents as learning partners in the development of technological fluency.

Bell, P., Bricker, L.A., Lee, T.R., Reeve, S., & Zimmerman, H.T. (2006). Understanding the cultural foundations of children's biological knowledge: Insights from everyday cognition research. In S.A. Barab, K.E. Hay, and D.T. Hickey (Eds.), *Proceedings of the Seventh International Conference of the Learning Sciences* (pp. 1029-1035). Mahwah, NJ: Lawrence Erlbaum Associates.

Barton, A.C. (2001). Science education in urban settings: Seeking new ways of praxis through critical ethnography. *Journal of Research in Science Teaching, 38*(8), 899-917.

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

Bruner, J. (1990). *Acts of meaning*. Cambridge, MA: Harvard University Press.

Cajete, G. (1999). *Native science.* Santa Fe, NM: Clear Light Publishers.

Chen, M. (in review). Communication, coordination, and camaraderie.

Cole, M. (1996). *Cultural psychology: A once and future discipline.* Cambridge, MA: Harvard University Press.

Collins, H., & Evans, R. (2007). *Rethinking expertise*. Chicago, IL: Chicago University Press.

Donehower, K., Hogg, C., & Schell, E.E. (2007). *Rural literacies*. Carbondale, IL: Southern Illinois University Press.

Epstein, S. (1996). *Impure science: AIDS, activism, and the politics of knowledge*. Berkeley, CA: University of California Press.

Ericsson, K.A., Charness, N., Feltovich, P.J. & Hoffman, R.R. (Eds.). (2006). *The Cambridge handbook of expertise and expert performance*. Cambridge, UK: Cambridge University Press.

Gruenewald, D.A. (2003a). Foundations of place: A multidisciplinary framework for place-conscious education. *American Educational Research Journal*, *40*(3), 619-654.

Gruenewald, D.A. (2003b). The best of both worlds: A critical pedagogy of place. *Educational Researcher, 32*(4), 3-12.

Hakkarainen, K., Palonen, T., Paavola, S., & Lehtinen, E. (2004). *Communities of networked expertise: Professional and educational perspectives.* Amsterdam, Netherlands: Elsevier.

Harding, S. (1991). *Whose science? Whose knowledge?: Thinking from women's lives*. New York, NY: Cornell University Press.

Harris, M. (1987). *Cultural anthropology* (2nd ed.). New York, NY: Harper & Row Publishers.
Hidi, S., Renninger, K.A., & Krapp, A. (2004). Interests, a motivational variable that combines affective and cognitive functioning. In D.Y. Dai & R.J. Sternberg (Eds.), *Motivation, emotion, and cognition: Integrative perspectives on intellectual functioning and development* (pp. 89-115). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
Hodges, N.J., Starkes, J.L., & MacMahon, C. (2006) Expert performance in sport: A cognitive perspective. In K.A. Ericsson, N. Charness, P.J. Feltovich, and R.R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 471-488). Cambridge, UK: Cambridge University Press.
Hutchins, E. (1995). *Cognition in the wild*. Cambridge, MA: The MIT Press.
Jenkins, H. (2006). *Convergence culture: Where old and new media collide*. New York: New York University Press.
Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge, UK: Cambridge University Press.
Layton, D., Jenkins, E., Macgill, S., & Davey, A. (1993). *Inarticulate Science? Perspectives on the public understanding of science and some implications for science education*. Leeds, UK: University of Leeds.
Lewis, S., & James, K. (1995). Whose voice sets the agenda for environmental education? Misconceptions inhibiting racial and cultural diversity. *Journal of Environmental Education, 26*(3), 5-12.
Lugones, M. (2003). *Pilgrimages/peregrinajes: Theorizing coalition against multiple oppressions*. Lanham, MD: Rowman & Littlefield Publishers, Inc.
Malaby, T. (2006). Parlaying value: Capital in and beyond virtual worlds. *Games & Culture, 1*(2), 141-162.
Norman, G., Eva, K., Brooks, L., & Hamstra, S. (2006). Expertise in medicine and surgery. In K.A. Ericsson, N. Charness, P.J. Feltovich, & R.R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 339-354). Cambridge, UK: Cambridge Univ. Press.
Pike, K.L. (1954). *Language in relation to a unified theory of the structure of human behavior.* Ann Arbor, MI: Braun-Brumfield, Inc.
Pinkard, N., Barron, B., Martin, C.K., & Gomez, K. (2007). Digital youth network: Fusing school and after-school contexts to develop youth's new media literacies. Unpublished manuscript.
Rogoff, B., & Lave, J. (1984/1999). *Everyday cognition: Development in social context*. Cambridge, MA: Harvard University Press.
Selinger, E., & Crease, R.P. (Eds.). (2006). *The philosophy of expertise*. New York, NY: Columbia University Press.
Stanley, W.B. & Brickhouse, N.W. (2001). Teaching sciences: The multicultural question revisited. *Science Education, 85*, 35-49.
Steinkuehler, C. (2007). Massively multiplayer online gaming as a constellation of literacy practices. *eLearning, 4*(3), 297-318.
Taylor, D.E. (1996). Making multicultural environmental education a reality. *Race, Poverty & the Environment, 6*(2&3), 3-6.
Taylor, T. L. (2006). *Play between worlds: Exploring online game culture.* The MIT Press.
Wynne, B. (1992). Misunderstood misunderstandings: Social identities and public uptake of science. *Public Understanding of Science, 1*(3), 281-304.

Acknowledgements

The researchers would like to acknowledge the substantial and generous involvement of the research participants involved in the ethnographic studies described in this session, without whom these accounts of expertise development would not have been possible.