Indiana University 2006

Proceedings of ICLS 2006

Indiana University
Bloomington, Indiana, USA
June 27th – July 1st, 2006

Edited by
Sasha A. Barab
Kenneth E. Hay
Daniel T. Hickey

Support Provided by the Indiana University School of Education, the National Science Foundation and the Indiana University International Travel Program

Published by:
International Society of the Learning Sciences
http://www.isls.org/

Distributed by:
Lawrence Erlbaum Associates
10 Industrial Avenue
Mahwah, NJ 07430-2262
http://www.erlbaum.com/

Printed in the USA

ISBN 0-8058-6174-2 Vols. 1 and 2
ISBN 0-8058-6175-0 CD

Cover & Logo Design by:
Paul Whitener Jr.
Empowered Media, LLC
paul@empoweredmedia.org

Preface

Learning sciences research explores the nature and conditions of learning as it occurs in educational environments, broadly construed. The learning sciences field draws upon multiple theoretical perspectives and research paradigms in order to understand and improve human learning, cognition, and development. Over the last two decades the learning sciences community has developed powerful technological tools, curricular interventions, theories, and methods for understanding and improving teaching and learning as it unfolds in naturalistic contexts.

Learning sciences takes an interdisciplinary approach to the study of learning, cognition, and development in real-world contexts. Learning scientists believe that any investigation of teaching and learning must consider context, cognition, and learning architecture, which we treat as inextricably intertwined. All who are interested in the study of learning in context and the design of learning environments should find the work in these Proceedings to be of interest.

While learning scientists can present rich accounts of learning in complex contexts, convincing policy makers, teachers, and other researchers of the theoretical and practical value of our work; it is not a straightforward process. We must show impact at the local level, while at the same time working to advance claims that have more general value. In other words, we must make clear that the learning sciences make a difference.

Toward this end, the *Seventh International Conference of the Learning Sciences (ICLS 2006)* is explicitly focused on the theme "Making a Difference." Much of the work in these Proceedings demonstrates how our work is making a difference: to students, teachers, schools, and policy makers; to research approaches and methods; to theories and models of learning, instruction, and assessment. Each proposal in these Proceedings was blind reviewed by three independent reviewers to ensure high quality work. We hope that others will find the lessons shared in these pages relevant to their work.

Acknowledgements

Organizing this meeting was a substantial undertaking. Receiving and reviewing proposals, assembling the Proceedings, and organizing the actual conference required many hands. There are many people we owe our sincere thanks in making this year's conference a reality.

We offer special thanks for the tireless hours and work of Melissa Goodnight and Karla Frownfelter in organizing these Proceedings. Similarly, our designer Paul Whitener also made many last-minute changes and developed the artwork. Their hard work has made the editors and the contributors look their best.

We would like to thank members of the Indiana University community for their support, both personnel and monetary. These include IU Learning Sciences Program and Program Head, Dick Lesh; the IU Center for Research Learning and Technology; IU School of Education and Dean Gerardo Gonzalez; IU School of Informatics and Dean Michael Dunn; IU Office of

International Programs; IU Vice President of Research, Michael A. McRobbie; and IU Office of the Chancellor.

Putting on a conference for the first time can be an overwhelming and complex enterprise. Mary Morgan of the IU Conferences office has been an amazing resource and help in juggling all of the demands of a conference co-chair. We would like to extend our sincere thanks for her tireless work, patience and persistence. We would also like to thank IU Learning Sciences Professor Tom Duffy for his initial involvement in organizing the conference.

The National Science Foundation has been a consistent supporter of past and current meetings the ICLS. We would like to once again recognize the foundation and program officers (particularly Elizabeth VanderPutten, Robert Sherwood, and Larry Suter) for their commitment to the field through the significant support of *ICLS 2006*. Special recognition should be mentioned for their support of graduate students and early career scholars. Their forward thinking and support will pay great dividends in the quality of our future.

This is the first ICLS that has had the benefit from a fully formed International Society of the Learning Sciences (ISLS) organization to support and guide the development of the conference. In particular, we would like to thank ISLS members Janet Kolodner, Roy Pea, Claire O' Malley, Nancy Songer, William Sandoval, Chris Hoadley, Danny Edelson, and Cindy Hmelo-Silver for their help and guidance. We would also like to acknowledge the suggestions and help of other ISLS members, particularly our international colleagues, including Paul Kirschner, Sanna Jarvela, Bronwyn Stuckey, and Hans Spada.

We would also like to give a special thanks to the *ICLS 2004* chair, Yasmin Kafai, in helping us plan for the hills and valleys of conference work. Her wisdom in handling the many issues of the *ICLS 2006* has been much appreciated. We hope to do the same for the *ICLS 2008* chairs.

Finally, we would like to recognize the many individuals who reviewed the submitted proposals for all their hard work and the contributors that make the ICLS an exciting conference. We are sure that their creativity and scholarship will make the *ICLS 2006* and these Proceedings a significant contribution to the Learning Sciences community.

Chairs

Sasha A. Barab
Kenneth E. Hay
Daniel T. Hickey

ICLS 2006 CONFERENCE PROGRAM

Conference Co-chairs

Sasha Barab, Indiana University, Bloomington
Kenneth Hay, Indiana University, Bloomington
Daniel Hickey, Indiana University, Bloomington

Conference Steering Committee

ISLS Board Representatives
- Daniel Edelson, Northwestern University
- Cindy Hmelo-Silver, Rutgers University
- Yasmin Kafai, UCLA

International Relations
- Paul Kirschner, Open University of the Netherlands
- Bronwyn Stuckey, Queensland University of Technology

Doctoral Consortium
- Susan Goldman, University of Illinois, Chicago
- Claire O'Malley, University of Nottingham

Jr. Consortium
- Janet Kolodner, Georgia Institute of Technology
- William Sandoval, UCLA

Workshops
- Christopher Hoadley, Pennsylvania State University
- Sanna Jarvela, University of Oulu, Finland

Conference Coordination and Registration
- Mary Morgan, Indiana University Conferences

Student Volunteers
- Joyce Alexander, Indiana University

Web Design
- Paul Whitener, Empowered Media

ICLS 2006 Reviewers

The conference organizers sincerely thank the following individuals who reviewed proposals for the ICLS 2006 conference:

Dor Abrahamson
Faisal Ahmad
Valarie Akerson
Tonya Amankwatia
Chris Amelung
Heejung An
Kate Anderson
Charoula Angeli
Xornam Apedoe
Margret Arnold
Roger Azevedo
Xin Bai
Sasha Barab
Judith Barak
Michael Barnett
Philip Bell
David Bergin
Marina Bers
Madhumita Bhattacharya
Kristen Blair
Paulo Blikstein
Chutima Boonthum
William Brescia
Leah Bricker
Stephen Briner
Sean Brophy
Matthew Brown
Amy Bruckman
Stein Brunvand
Thomas Brush
Roland Bullard
Olin Campbell
Reality Canty
Antonella Carbonaro
Karen Carney
Darla Castelli
Alice Cavallo
Stephanie Cawthon
Hsin-Yi Chang
Elizabeth Charles
Clement Chau
Fei-Ching Chen
Weiqin Chen
Ellina Chernobilsky
Cynthia Carter Ching
Clark Chinn
Doug Clark
Jody Clarke
Tamara Clegg
Allan Collins
Albert Corbett
Jennifer Crawford
Theresa Cullen
Chandima Cumaranatunge
Laura D'Amico
Joshua Danish
Elizabeth Davis
Jason Day
Chris Dede
Donna DeGennaro
Rodrigo del Valle
Vanessa Dennen
Ning Ding
Chaoyan Dong
Corey Drake
Oliver Dreon Jr.
Amy Duffy
Thomas Duffy
Ravit Golan Duncan
Nicholas Duran
Angela Eckhoff
David Eddy Spicer
Daniel Edelson
Eric Ellis
Noel Enyedy
Eva Erdosne Toth
Bernhard Ertl
Howard Everson
Deborah Fields
Barry Fishman
Jim Foley
Paola Forcheri
Andrea Forte
Ina Fourie
Ruth Gannon-Cook
Elhanan Gazit
Xun Ge
Libby Gerard
Janice Gobert
Yuksel Goktas
Ricki Goldman
Susan Goldman
Amelia Gotwals
Jamillah Grant
Ingrid Graves
Jeffrey Greene
Melissa Gresalfi
Phyllis Grummon
Alan Hackbarth
Tony Hall
Bruce Havelock
Kenney Hay
Libby Hemphill
Phillip Herman
Daniel Hickey
Thomas Hills
Cindy Hmelo-Silver
Christopher Hoadley
Douglas Holton
YaHuei Hsu
Roland Hubscher
Jim Hudson
Barbara Hug
Andy Hurford
Yavuz Inal
Adam Ingram-Goble
Ioan Gelu Ionas
Asghar Iran-Nejad
Michael Jacobson
Heisawn Jeong
Kirk Job-Sluder
Aditya Johri
Frankie Jones
Diana Joseph
Yih-Ruey Juang
A. Susan Jurow
Yasmin Kafai
Ugur Kale
Yael Kali
Yanrong Kang
Haijun Kang
Lijie Kang
Victor Kaptelinin
Manu Kapur
Diane Jass Ketelhut
Beaumie Kim
Bosung Kim
Nari Kim
Yanghee Kim
Paul Kirschner
Ben Kirshner
Jayne Klenner-Moore
Melissa Koch
Janet Kolodner
Timothy Koschmann
Beth Kubitskey
Maria Lorna Kunnath
Eun Ju Kwon
Eleni Kyza
James Laffey

Eduardo Lage-Otero
Minna Lakkala
Mary Lamon
Christine Larson
Fai-Kim Lau
Mike Lawson
Victor Lee
JeongMin Lee
Youngmin Lee
Yu-Wei Lee
Mary Leonard
Dalit Levy
Junlei Li
Erin Lightman
Cher Ping Lim
Jung Lim
Guan-Yu Lin
Hsien-Ta Lin
Marcia Linn
Jordan Lippman
Lei Liu
Pei-Ju Liu
Shijuan Liu
Kate Lockwood
Steven Lonn
Loucas Louca
April Luehmann
Kenneth Luterbach
Leilah Lyons
Maria Madiope
Mouna Mana
Rebecca Mancy
Lina Markauskaite
Sandra Martell
Thomas Martens
Fred Martin
Julia Matuga
Philip McCarthy
Michael McCracken
Scott McDonald
Steven McGee
Diane McGrath
Katherine McNeill
Daniel McVeigh
Tom Moher
Gaëlle Molinari
Chrystalla Mouza
Hanni Muukkonen
Mitchell Nathan
Michael Nussbaum
Kevin O'Connor
Claire O'Malley
Maria Opfermann
Chandra Orrill
Jakita Owensby
Ming Fai Pang
Praveen Paritosh
Sanghoon Park
Orit Parnafes
Roy Pea
William Penuel
Hans-Rüdiger Pfister
Corey Pierce
Philip Piety
Niels Pinkwart
Joe Polman
Cassidy Puckett
Sadhana Puntambekar
Chris Quintana
Michael Reigh
Aaron Richmond
Jochen Rick
Ann Rivet
Jenny Robins
Cecil Robinson
Jennifer Robinson
Miky Ronen
Jeremy Roschelle
Michael Rowe
Nikol Rummel
Donna Russell
Nora Sabelli
Troy Sadler
Johann Sarmiento
Tom Satwicz
Leah Savion
Daniel Schwartz
David Shaffer
Patti Shank
Tamara Shanker
Brett Shelton
Miriam Sherin
Wesley Shumar
Bernadette Sibuma
Arnan Sipitakiat
Brian Smith
Hyo-Jeong So
Nancy Songer
Hans Spada
Kurt Squire
Tina Stanford
Haley Steele
Constance Steinkuehler
Reed Stevens
James Stewart
Mike Stieff
Helga Stokes
Jan-Willem Strijbos
Johannes Strobel
Bronwyn Stuckey
Florence Sullivan
Daniel Suthers
Vanessa Svihla
Karen Swan
Elisabeth Sylvan
Ai-Girl Tan
Roger Taylor
Kona Taylor
Stephanie Teasley
YaTing Teng
Timothy Teo
Sharon Tettegah
John Thompson
Heather Toomey-Zimmerman
Stefan Trausan-Matu
Nobuyuki Ueda
Jody Underwood
Leo Ureel II
Phil Vahey
Mark van't Hooft
Wouter van Joolingen
George Veletsianos
Michelle Verges
Geeta Verma
Yusra Visser
Christian Voigt
Joan Walker
Andrew Walker
Feng Wang
Scott Warren
Armin Weinberger
Martin Wessner
Eun Won Whang
Tobin White
Astrid Wichmann
Eric Wiebe
Michelle Williams
Robert Williams
Clyde Winters
Alyssa Wise
Don Wortham
Kenneth Wright
Lisa Yamagata-Lynch
Jude Yew
Susan Yoon
Amir Abbas Zadpoor
Jose Zagal
Raul Zaritsky
BaoHui Zhang
Jianwei Zhang
Meilan Zhang
Steven Zuiker
Laura Zurita
Janet Zydney

Table of Contents

Volume I

Papers

Volume 2

Papers (continued)

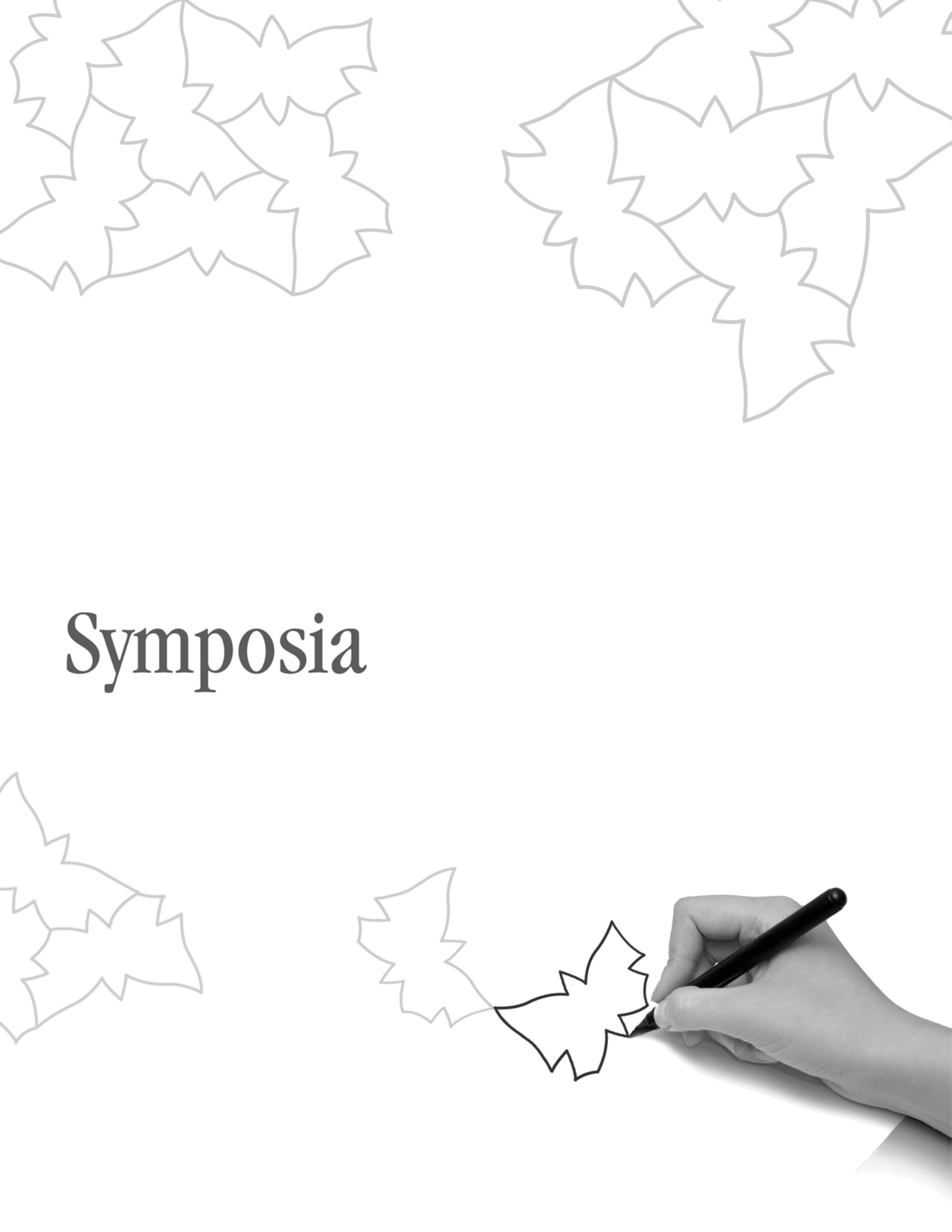
Posters

Symposia

Papers

Posters

Symposia



Clubs, Homes, and Online Communities as Contexts for Engaging Youth in Technology Fluency Building Activities

Brigid Barron, Stanford University, Barronbj@Stanford.edu
Yasmin B. Kafai, University of California, Los Angeles, Kafai@gseis.ucla.edu

Abstract: The goal of this session is to advance our understanding of the relationships between access to computing tools, learning opportunities, and the development of technological fluency. Understanding variability in the kinds of material and social resources that children have access to is crucial for a better understanding of how to create more equitable learning opportunities. Overview talks of three research programs and their theoretical frameworks will start this session. A poster session will follow that showcases nine empirical or design projects that have emerged from the research programs. In keeping with the conference theme, the overview presentations and empirical work highlight how learning to use technology in empowered ways can be nurtured within and across a broad range of contexts.

Overview

Adolescents typically use computers more frequently at home than they do at school (Kaiser Family Foundation, 2004; Pew, 2002). During this out of school time the social contexts of their use and the nature of the activities vary widely. Although playing games is a common activity, children and teens also use the computer to communicate with friends, do research for school, find information about hobbies, and to download and listen to music. Some teens also use their computing tools for activities that involve authoring such as multimedia story writing, robotics, programming, or web design. These creative activities are particularly likely to build aspects of what has been called technological fluency as they require some understanding of fundamental concepts and frequently a great deal of persistence and trouble shooting (NRC, 1999). Recent research suggest that opportunities to engage in fluency building activities out of school are not equally distributed. Children who have greater access at home to tools such as high speed Internet access, scanners, cameras, and printers are more likely to have engaged in fluency building activities (Barron, Shatz, & Martin, in preparation). However, the strong association between access to tools at home and experience can be moderated when learning opportunities are provided for elsewhere such as in after school clubs or community centers (Resnick, Rusk, & Cooke, 1998).

In this symposium we discuss three research programs that are designed to advance our theoretical understanding of how learning to use technology in empowered ways can be nurtured within and across a broad range of contexts. In addition, we hope to advance the conversation about how to empirically document learning that occurs out of school. We believe that understanding variability in the kinds of material and social resources that children have access to is crucial for a better understanding of how to create more equitable learning opportunities. The research that will be presented includes data from children who have high levels of interest, access at home to knowledge resources and tools, and opportunities to participate in out of school summer camps or online classes that are funded by their parents as well as children who have interest but little to no access at home and find resources through after school clubs or community centers that provide opportunities for fluency building activities. The session will begin with a 30 minute overview consisting of three papers that will summarize the research programs and theoretical frameworks that drive them. Next, audience members will have 45 minutes to visit the nine posters. For the final 15 minutes of the session the authors will gather and the audience will be invited to participate in an open discussion.

Overview Paper I. Mapping learning across contexts: The role of informal and school based contexts in the emergence of expertise and the development of interest

Brigid Barron

Understanding how learning to use technology is distributed among multiple settings and resources is an increasingly important goal. There are widespread concerns about inequities among children in whether they learn to use computers in ways that can promote their own development and about who becomes interested in pursuing advanced knowledge that would position them to work in technological design fields (AAUW, 2000; Attewell, 2001; Camp, 1997). Schools are being asked to cultivate technological fluency, digital literacy, and other 21st

century competencies (NRC, 1999). Yet, as with other subjects, schools differ widely in the kinds of learning resources they offer (Warschauer, 2000). A better understanding of how learning takes place across settings and of the possible synergies and barriers between learning contexts may help educators find ways to supplement school based learning. To make progress on understanding learning across the life spaces of home, school, community, work, and neighborhood we need frameworks and perspectives that help articulate questions that will advance theory and guide data collection.

In this paper a learning ecologies framework for studying the emergence of interest and the development of technological fluency is presented. A learning ecology is defined as the set of contexts, comprised of configurations of activities, material resources, and relationships found in physical or virtual spaces that provide opportunities for learning (Barron, 2004). A *learning ecologies perspective* foregrounds that 1) adolescents are simultaneously involved in many settings; 2) they are active in creating activity contexts for themselves within and across settings, and 3) that interest driven activities tend to be self-sustaining given adequate resources. In this overview paper conjectures about the development of interest and the dynamics of how a learning ecology can develop over time will be presented along with ideas for how we might collect data to test some of these ideas and inform the design of learning environments.

Poster 1. **Profiles of interest, access, and fluency building experience in Silicon Valley: When interest isn't enough.** Colin Schatz, Brigid Barron, and Sarah Walter, Stanford University

In order to better understand who gains access to fluency building experiences, survey and interview data was collected from an economically diverse group of middle school students attending one of two public schools in the Silicon Valley region. In this report we share analyses that examine the relationship between teens' experience with fluency building activities and a number of variables including access to tools at home, use of a various learning resources, and interest in learning about computing technology. Our results suggest that the children with the most experience typically have high levels of interest and access to tools at home but that students who have high interest without tools at home sometimes find ways to gain these experiences inside or outside of school. Results from cluster analysis further suggest a compelling set of three different profiles of students based on the variables of fluency, interest and home access to tools. Notably, students matching a profile of low fluency and limited home access to tools but high interest appear to exhibit a different general pattern of technology use (e.g., participating more frequently in entertainment activities than in communication or learning activities involving technology) compared to students matching a profile of high interest, access and fluency or to students matching a profile of high access, medium interest, and average fluency. Results from analysis of individual activities are also notable: Students matching the first profile, for instance, reported playing educational games and writing for fun substantially more often than average for the overall sample population; Moreover, they used "instant messaging" substantially less often than average, while instant messaging was an activity among the most frequent activities for students matching the other two profiles. Interview data help present more detailed profiles of the learning ecologies of students who vary in their experience/resource/interest profiles.

Poster 2. **Community-based computer clubhouses as contexts for bridging divides: Evidence for their central role in supporting the technological fluency of children without home access**. Caitlin Martin, Susie Wise, Brigid Barron, and Sarah Lewis, Stanford University

In order to look more deeply at the learning ecologies of youth who have found a way to develop technological fluency despite low home access, we conducted two years of ethnographic research in technology programs at after-school community centers in areas with low SES. We developed a set of case portraits of youth in this environment through weekly participant observation, surveys and interviews conducted with participants around their technology projects and experiences, and interviews with parents and staff. Our poster will discuss youth whose central source of fluency development is the community center, focusing on cases from two club contexts: a computer clubhouse space and a long-term web design program. Results suggest that youth are highly interested in the opportunities and that some are able to use the human and material resources at the community center to build fluency, but that there are few instances where this excitement and knowledge are nurtured by other contexts like school. We will frame the cases in the local community, drawing on survey and interview data collected from 160 students from a local middle school that was located 1.7 miles away from the community center that served as a focal context for our research.

Poster 3. **The role of online and face-to-face social networks in nurturing interest and experience**. Rachel Fithian, Brigid Barron, Karin Chapin, and Lori Takeuchi, Stanford University

This poster presents findings from recent case studies of middle school children in Silicon Valley who exhibit high levels of technological fluency and engagement. A primary goal of conducting these case studies was to gain understanding of the learning ecologies that support these high-fluency children including their social networks and access to learning activities in an out of school. We share the stories of two children from this set of case studies and the role that online and "live" communities play in their learning and development. "Layla" is on her school's math team and participates in an online math forum. Layla's mathematical expertise is central to her identity, and her involvement in this forum led to her interest in learning about programming which she acted on by enrolling in a class at school. "Caleb" is experienced in the fields of computer science and technology; he started programming and tinkering at toddler age and has amassed an extensive resume of technological accomplishments. In interviews, Caleb presents himself as a contributing member of a "live" community of technology experts. While both children are members of learning communities, the motivations they express for membership, their pathways into participation, and the outcomes of involvement differ. We will discuss themes around the role of community including contribution to feelings of belonging and identity, and positioning in larger networks involving issues of power hierarchies and molding the future.

Overview paper II: Supporting Urban Youth in Developing Empowered Technology-User Identities by Bridging Home, School and Afterschool Contexts

Diana Joseph & Nichole Pinkard

Many middle-class children naturally and automatically acquire the technological fluency they need to successfully mediate school, home and community environments. In stark contrast, for the majority of children from low-income urban families, this experience is far from reality. Our project aims to level the playing field by scaffolding the development of empowered technology user identities in disadvantaged urban youth. Extensive research has highlighted the importance of identity as a determiner of goals and effort (cf. Eccles et al, 1983). Cultural factors play a key role in determining identities that operate in academic and work settings (cf van Knippenberg, 2000). Our work places this set of ideas at the center of the design of a program to foster technological fluency associated with identities that empower urban youth to work and play in new media domains.

Working in the middle school grades at an urban charter elementary school, we have begun to implement Digital Youth, a program that spans the worlds of school, home, and after-school activities. Our program immerses youth in frequent, substantial, meaningful, pleasurable technology learning opportunities in multiple ecological settings (Barron, 2004). Through this immersion, they develop technological fluency and take on identities as powerful users, creators, and teachers of technology. We believe that as young people begin to contribute technological expertise across their environments, they will develop the knowledge, dispositions, skills, and social connections to enter technology careers and degree programs.

The Digital Youth program serves approximately sixty middle-school students at an urban charter school serving African-American students. Each student has a laptop for their own use in and out of school. The school curriculum integrates the use of laptops, especially in milestone projects in the major academic content areas. After school, students participate in interest-based clubs. In addition, workshops highlight key skills needed in school and in clubs, including tool workshops (such as Excel Basics and FinalCut ProBasics) and skill workshops (Digital Storytelling, Teaching Technology Skills to Peers). Skilled participants offer tutorial office hours to other young people before and after school. We aim to provide summer internship opportunities for students who have earned an advanced credential. Because the laptop travels home with students, families have new opportunities to learn about technology, and to identify their children as technology experts. A centerpiece of the program is the credentialing system, which articulates skills that learners can demonstrate in order to earn specific quasi-professional titles, rights and responsibilities. Our presentations in this symposium highlight design and preliminary findings from the pilot year of the Digital Youth program.

Poster 1. **Three club designs to foster the development of empowered identities.** R. Benjamin Shapiro, Karla Thomas, Nick Jaffe & Todd Carter, University of Chicago

In an effort to create a sustainable model, the Digital Youth program makes use of club leaders and club models from a variety of sources. This poster highlights similarities, differences, and examples of student work, and preliminary design lessons found by looking across three club designs. These clubs are intended to draw students into new identities as technology users. Video Game Design Club is led by a graduate student with technical and learning environment design skills. The work involved in this club takes place mainly in the virtual space of Alice (http://www.alice.org/), with occasional use of platform gaming systems. The club is physically set in the school's science classroom, including substantial infrastructure designed to support purposes other than those of the club. Robotics Club is led by four professional engineers at a major firm. The club is centralized around a Lego robotics competition, and the attendant materials. This club works in a space used only after school. Digital Music is led by two musicians with extensive experience as club leaders and creators of digital music studios in schools. They have created an established and articulated learning environment designed and tested over several years. Their work takes place in a digital music studio with instruments, microphones, computers and other recording equipment, built into what once was a small office in the school. The space is designed so that, as in a professional studio, each physical object has a specific location and routines for its use. This poster describes the implications of club leader experience, curriculum design, physical materials, and space for identity development.

Poster 2. **Digital connectors: Using human resources to bridge between existing sociocultural identities and new empowered technology-user identities.** Nichole Pinkard and Tiffanie Jackson, University of Chicago

Researchers such as Gee (2003), Bryson et al. (2003) and Pinkard (2005) conjecture that many children, especially minority youth, lack access to digital savvy mentors whose presence and products could serve to engage other youth in acquiring new media literacies. Gender research (Bryson & de Castell, 1996; de Castell& Bryson,1997; Hawkins, 1985) has shown that the lack of female role models and female peers willing to engage in technical courses dramatically limits the number of women willing to pursue activities that require technological abilities. Barron (2004) suggests that youth new to programming are more likely to learn from a peer or parent in an informal context while a technically experienced youth was more likely to take courses and learn from books. In order to invite learners into taking on new identities, our design calls on adults with expert identities in technology fields, and adults with whom young participants in our program identify. Drawn from local colleges, universities and an arts education organization, club and workshop leaders create as well as social environments that reflect how technology user identities operate in the real world. At the same time, they interpersonal connections with students that we expect will allow them to guide these youth in moving toward taking on technology identities. In this poster, a club leader and the program manager present initial designs at the program and club levels, and describe participant responses.

Poster 3. **Credentials as an invitation to empowered technology-user identities.** Diana Joseph and Akili Lee, University of Chicago

Young people develop clear images of the learning stages required to accomplish goals connected to identities they care about (Nasir, 2002). We conjecture that most urban youth have limited exposure to adults in technology professions. The identities associated with these types of careers are likely to appear unattainable or undesirable. To help students get on the path for technology-based careers, we must first help them perceive how technological skills are related to desirable identities, how they are developed over time and how they enable lead to new and more interesting tasks. Similarly, we want students to understand how technologists interact with, educate, and problem solve with their peers, and push each other's thinking and creativity. In order to guide youth in learning new media literacies and adopting identities that highlight their growing knowledge, we are creating a system of credentials. These credentials, based in professional work identities, lay out requirements for demonstrations of skills and ethical practices. These demonstrations lead to related rights that serve the needs and capacities of the school and community. For example, a youth who demonstrates web design skills and ethics and thus earns the Webmaster credential might acquire the right to post pages on the school's website, and the responsibility to manage a section of that website. view the credential system as an important vehicle for helping youth understand the language and relationship between new media literacies, and how to move from one set of

skills to the next. We conjecture that as youth complete certifications along a developmental pathway they will begin to internalize the language, skills, processes, affordances and constraints of new media literacies.

Overview Paper III: Beyond Point & Click: Creating Programming Technologies and Opportunities for Supporting Technology Fluency in Afterschool Programs

Yasmin Kafai

Many after-school programs have been installed to compensate for the lack of computer resources found in low-income communities. Congress appropriated over $991 million for after-school programs in 2005 for the 21st Century Community Learning Centers (CCLC) Program. These after-school programs not only include academic and extracurricular activities, but also technology education programs. There are currently more than 2,000 Community Technology Centers (CTCs) and related projects serving low-income and minority students nationwide. These include libraries, youth organizations, settlement houses, housing development centers, and stand-alone computing centers (Schwartz, 2003). Most of these after-school programs offer structured, directed instruction on basic computer operation, software application packages and basic internet use very much like the "point & click" vocational classes students encounter in their schools. Even those few offering a less structured environment, without pre-existing instructions or adult-led classes, focus on self-contained software packages, such as educational games and interactive storybooks. Hardly any program attempts to offer programming as part of their afternoon activities. Opportunities to learn about creative applications and programming in community technology settings are virtually absent.

Our presentations will focus on findings from two years of developing and implementing a new media-rich programming environment and activities in a Los Angeles community technology center (CTC) visited by a predominantly Latino/a and African-American youth ages 8-18. Unlike most schools, the guiding philosophy of our CTC had already cast a wider net around technology use and design by promoting access to technology fluency — in contrast to computer literacy — and by emphasizing personal expression as an essential catalyst for the learning and use of technology (NRC, 1999). The center, where children and youth are considered "members" (as opposed to students) of a learning community, encourages them to devise multi-media, multi-application activities that are founded upon their personal interests (Resnick, Rusk, & Cooke, 1998). Yet our initial observations at the site revealed that programming, unlike many other creative technologies, was not part of the members' activities.

Our framework which builds on Jeannie Oakes (1992) model examines the political, normative and technical dimensions that inform the introduction of technology fluency activities within the CTC. We address the "technical changes" such as the development of a new media-rich programming environment, approaches to mentoring, and new activities that are critical but not sufficient in introducing change. The *normative* dimensions address deep-seated beliefs about what kind of technology activities are appropriate for community members. Finally, the *political* dimensions focus on the cross-institutional relationships and alliances between the CTC and other organizations that are aimed at addressing the lack of technology fluency. These political changes are critical, in that they build necessary support for providing both the commitment and resources for the changes to occur, and to be sustained. Such analytical lenses are not often discussed within the learning sciences but they will help us understand the resistances and opportunities in changing activity structures and interaction processes.

Poster 1. **Designing Software to Foster Technological Fluency in Community-Based Learning Centers**. Mitchel Resnick, MIT

This poster will discuss the guiding principles underlying the design of a new programming environment, called Scratch, that is grounded in the practices and social dynamics of Computer Clubhouses, a network of after-school centers in low-income communities. Scratch adds programmability to the media-rich and network-based activities that have proven most popular among youth at Computer Clubhouses. With Scratch, kids can create new types of digital-arts projects, dynamically transforming images with Photoshop-like filters, mixing in sound clips and drum beats, and integrating inputs from real-world sensors. Scratch is designed to make computer programming more accessible and motivating, expanding the range of what Clubhouse members can design and create with computers, while also helping them learn important concepts and ways of thinking associated with computer programming.

Poster 2. **Creative Partnerships: New Approaches to Mentoring as Pathways towards Technology Fluency**. Yasmin B. Kafai, Kylie Peppler, Shiv Desai, and Grace Chiu, UCLA

This poster presents a recent intervention that introduced undergraduate mentors into programming and provided support for programming projects in CTCs. While community service learning (Vogelsang & Astin, 2000) is now considered an essential part of undergraduate education, it is seldom done with the intention of having undergraduates learn new skills — let alone advanced skills like programming — for the purposes of mentoring in a community technology center. Traditionally, one would expect to have computer science and not liberal arts majors mentoring young children in learning programming. However, we contend that inexperienced programmers are a valuable resource for members because the undergraduates are able to provide support and collaborate with members creating a more equitable partnership. We will present findings from an analysis of mentor/mentee interactions results from two undergraduate classes in the education minor that participated in this effort, highlighting their perceptions of mentoring and their relationship to technology before and after the intervention.

Poster 3. **Hook-ups: Integrated Physical and Virtual Design**. Amon D. Millner, MIT

This poster discusses a new initiative, called Hook-ups, that engages youth in multiple, integrated types of design activities. In working on Hook-ups projects, youth build physical input devices to control computer programs that they write themselves. The poster focuses on the relationships between three aspects of the Hook-ups building experience: collaboration, physical design, and virtual design. We present examples from diverse youth working on Hook-up projects at Computer Clubhouse after-school centers. Several cases are presented where learners work alone, in groups, and begin projects by planning or tinkering with physical or virtual objects. We also discuss design criteria for technical and social aspects of the Hook-ups project.

References

American Association of University Women (2000). *Tech-savvy: Educating girls in the new computer age*. Washington, DC: Educational Foundation of the American Association of University Women.

Attewell, P. (2001). *Children of the digital divide*. Paper presented at the annual meetings of the American Educational Research Association, New Orleans, USA.

Barron, B. (2004). Learning Ecologies for Technological Fluency: Gender and Experience Differences. *Journal of Educational Computing Research*, 31(1), 1-36.

Barron, B. (accepted for publication). Interest and self-sustained learning as catalysts of development: A learning ecologies perspective. To appear in *Human Development*.

Barron, B., Shatz, C. & Martin, C. (in preparation). Profiles of interest, access, and fluency building experience in Silicon Valley: When interest isn't enough. Manuscript in preparation.

Bryson, M., Petrina, S., de Castell, S., & Braundy, M. (2003)."Conditions for Success"?" Sex-disaggregated analysis of performance and participation indicators in technology-intensive courses in B.C. secondary schools. *Canadian Journal of Science, Mathematics and Technology*, 3, 185-195.

Bryson, M. & de Castell, S. (1996). Learning to make a difference: Gender, new technologies, and in/equity. *Mind, Culture and Activity*, 2(1), 3-21.

Camp, T. (1997). The incredible shrinking pipeline. *Communications of the ACM*, 40(10).

de Castell, S, & Bryson, M. (Eds.). (1997). Radical in<ter>ventions: Identity, politics, and difference/s in educational praxis. Albany, NY: SUNY Press.

Eccles, J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J. L., et al. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motivation* (pp. 75-146). San Francisco: W. H. Freeman.

Gee, J. (2003). *What video games have to teach us about learning and literacy*. New York: Palgrave Macmillan.

Hawkins, J. (1985). Computers and girls: Rethinking the issues. *Sex Roles*, 13, 163–180.

Kaiser Family Foundation (2005). *Generation M: Media in the lives of 8-18 year olds*. Menlo Park, CA: Kaiser Family Foundation.

Nasir, N. (2002). Identity, Goals and Learning: Mathematics in Cultural Practice. *Mathematical Thinking and Learning*, 4(2 & 3), 213-247.

National Research Council (1999). *Being fluent with information technology*. A report of the Committee on Information Technology Literacy. Washington, DC: National Academy Press.

Oakes, J. (1992). Can tracking research inform practice? Technical, normative and political considerations. *Educational Researcher, 21*(4), 12-21.

Pew Reports. (2002). The digital disconnect: The widening gap between Internet-savvy students and their schools. Internet and American Life Project. Washington, DC. 4 August 2005. http://www.pewinternet.org/reports/toc.asp?Report=67.

Pinkard, N.(2005). How The Perceived Masculinity and/Or Femininity Of Software Applications Influences Students' Software Preferences In *Journal of Educational Computing Research*, 32, 57-78.

Resnick, M., Kafai, Y. B., & Maeda, J. (2003). *A Networked, Media-Rich Programming Environment to Enhance Technological Fluency at After-School Centers in Economically-Disadvantaged Communities*. Proposal (funded) to the National Science Foundation: Arlington, VA.

Resnick, M., Rusk, N., and Cooke, S. (1998). Computer Clubhouse: Technological fluency in the inner city. In D. Schon, B. Sanyal, and W. Mitchell (eds.), *High Technology and Low-Income Communities*. Cambridge: MIT Press.

Schwartz, W. (2003). After-school and community technology education programs for low-income families. New York: ERIC Clearinghouse on Urban Education. Retrieved on July 15th, 2005 at http://www.eric.ed.gov.

van Knippenberg, D. (2000). Work Motivation and Performance: A Social Identity Perspective. *Applied Psychology: An International Review*, 49(3), 357-371.

Vogelsang, L.J. & Astin, A. W. (2000). Comparing the effects of community service and service-learning. *Michigan Journal of Community Service Learning, 3*, 25-34.

Warschauer, M. (2000). Technology and school reform: A view from both sides of the track. *Educational Policy Analysis Archives*. 8(4).

Acknowledgements

Barron's research was supported by an NSF Early Career award (NSF REC – 0238524) and funds awarded through a Science of Learning Center grant from the National Science Foundation (NSF REC - 0354453), by an Iris Litt award, and by the International Collaborative Education Foundation. Kafai's research is conducted in collaboration with Mitchel Resnick's group at the MIT Media Lab and supported by a grant of the National Science Foundation (NSF-0325828). Joseph & Pinkard's work was supported by an NSF Early Career award granted to Pinkard (NSF-00333002) and by a grant from the John D. and Catherine T. MacArthur Foundation. The views expressed are those of the authors and do not necessarily represent the views of the supporting funding agencies or the host research institutions.