41st Annual Meeting of

The Jean Piaget Society

Society for the Study of Knowledge & Development

In association with the Institute of Human Development, University of California, Berkeley

June 2–4, 2011 • Berkeley, California, USA

Cultural Supports for Mathematical and Scientific Reasoning

Photo: Lindsey Snow, Glacier Edge Elementary School

Organizers: **Rich Lehrer & Leona Schauble**
(Vanderbilt University)

Plenary Presentations:
Andrea diSessa (University of California–Berkeley)
Deanna Kuhn (Columbia University)
Anne Marie Palinscar (University of Michigan)
Geoffrey B Saxe (University of California-Berkeley)
Reed Stevens (Northwestern University)

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Program Reviewers

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Local Arrangements Committee

The Jean Piaget Society would like to thank local arrangements chair, Linda M Platas and the following group of talented student volunteers: Melike Acar, Evra Baldinger, Kelly Campbell, Rose Cartwright, Danielle Champney, Kathryn Day, Kenton de Kirby, Irenka Dominguez-Pareto, Darrell Earnest, Jose Gutierrez, Mary Herbst, Sarah Hutchison, Bona Kang, Hee-Jeong Kim, Marie Le, Nicole Leveille Buchanan, Katherine Lewis, Nicole Louie, Justin Martin, Amanda McKerracher, Kelly Parry, Rebecca Poon, Emily Price, Daniel Reinholz, Jody Siker, Yasmin Sitabkhan, Hillary Swanson, Dragan Trninic, Ying Zheng.

Conference Program

Program created by Christopher E Lalonde and Larry Nucci. Program Planning Assistants: Melike Acar, James Allen, Irenka Dominguez-Pareto, Jose Gutierrez, Linda Platas, Tania Smethurst, Brian Waismeyer.

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The 41st Annual Meeting of the Jean Piaget Society

Cultural Supports for Developing Mathematical and Scientific Reasoning

Berkeley, California, June 2-4, 2011

Program Organizers: Richard Lehrer and Leona Schauble (Vanderbilt University)

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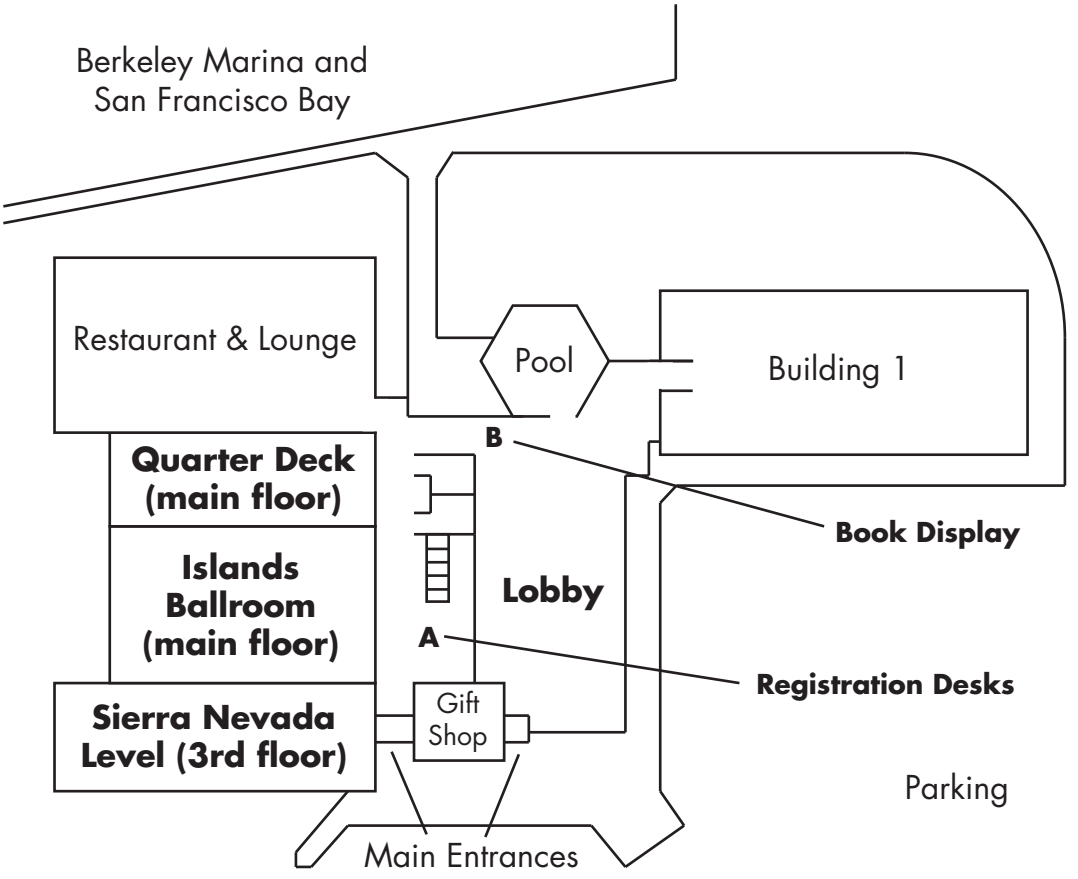

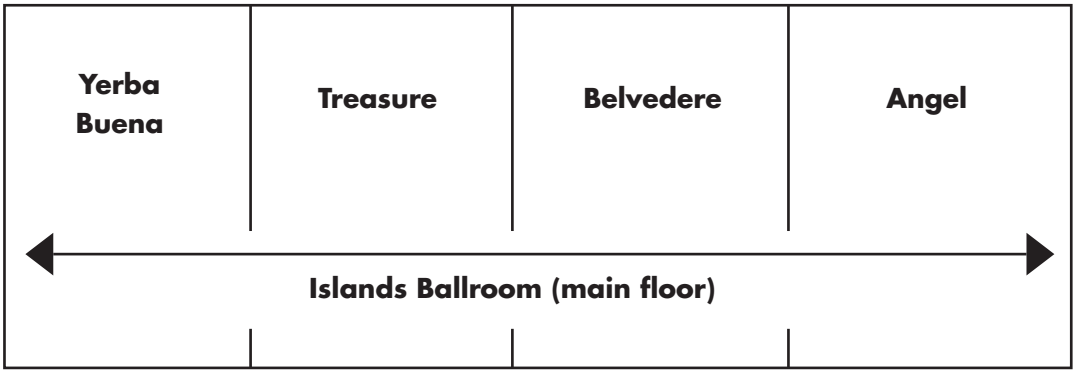

Program at a glance

THURSDAY	Ballroom	Belvedere	Yerba	Treasure	Angel	Amador	El Dorado	Mariposa
9:00-9:15	Opening							
9:15-10:30	PL01							
10:30-10:45	break							
10:45-12:15		IS01	SY01	SY02	SY03	PS01	PS02	PS03
12:15-1:30	Lunch							
1:30-2:45	PL02							
2:45-3:00	break							
3:00-4:30		IS02	SY04	SY05	SY06	DS01	PS04	PS05
4:30-4:45	break							
4:45-6:00		SY07	SY08	SY09	SY10	PS06	PS07	PS08
6:00-6:15		break						
6:15-6:45	PT01 Poster Session 1 (Quarter Deck)							
7:00-7:30	PT02 Poster Session 2 (Quarter Deck)							
6:30-7:30	REC1 President's Reception (Islands Ballroom)							
FRIDAY	**Ballroom**	**Belvedere**	**Yerba**	**Treasure**	**Angel**	**Amador**	**El Dorado**	**Mariposa**
8:00-9:00					FUND	RT01	RT02	SY11
9:00-10:30		SY12	SY13	SY14	DS02	PS09	PS10	PS11
10:30-10:45	break							
10:45-12:00	PL03							
12:00-1:15	Lunch (Annual Members Meeting 12:00-12:30 – Ballroom)							
1:15-2:45		IS03	SY15	PS12	SY16	SY17	PS13	PS14
2:45-3:00	break							
3:00-4:15	PL04							
4:15-4:30	break							
4:30-5:45		SY18	SY19	SY20	SY21	SY22	PS15	PS16
5:45-6:00	break							
6:00-6:30	PT03 Poster Session 3 (Quarter Deck)							
6:45-7:15	PT04 Poster Session 4 (Quarter Deck)							
6:30-7:30	REC2 Jacob's Foundation Reception for International Emerging Scholars (Islands Ballroom)							
7:30-8:30	MRES Mentor Roundtables for Emerging Scholars Session (Mariposa)							
SATURDAY	**Ballroom**	**Belvedere**	**Yerba**	**Treasure**	**Angel**	**Amador**	**El Dorado**	**Mariposa**
8:00-9:00					RT03	PS17	PS18	SY23
9:00-10:30		IS04	SY24	SY25	SY26	SY27	PS19	PS20
10:30-10:45	break							
10:45-12:00	PL05							
12:00-1:30	Lunch (Board of Directors Meeting – Quarter Deck)							
1:30-2:45		SY28	SY29	SY30	SY31	SY32	PS21	PS22
2:45-3:00	break							
3:00-4:30		IS05	SY33	SY34	SY35	PS23	SY36	PS24
4:30-4:45	break							
4:45-5:45	BOOK Book Discussion Session (Islands Ballroom)							

Program Overview—Thursday

Time	ID	Location	Event
9:00-9:15	OR	Ballroom	Opening Remarks: Geoffrey Saxe, conference organizers
9:15-10:30	PL01	Ballroom	Plenary Session 1: Geoffrey Saxe The emergence, reproduction, and change of collective representations and ideas: The study of small communities in New Guinea and the United States
10:30-!0:45	break		
10:45-12:15	IS01	Belvedere	Invited Session 1: William Sandoval (organizer) Contrasting everyday and disciplinary cultures of argument in math and science
	SY01	Yerba Buena	Symposium 1: Learning mathematics through representations: Integers, fractions, and the number line
	SY02	Treasure	Symposium 2: "Sugar and spice" and/or "puppy-dogs' tails": The sociogenesis of gender during early childhood
	SY03	Angel	Symposium 3: Cognitive aspects of mathematical learning
	PS01	Amador	Paper Session 1: Piagetian Theory I
	PS02	El Dorado	Paper Session 2: Executive Function and Social Development
	PS03	Mariposa	Paper Session 3: Theory of Mind
12:15-1:30	Lunch		
1:30-2:45	PL02	Ballroom	Plenary Session 2: Annemarie Sullivan Palincsar Investigations of text, talk, and activity in supporting scientific literacy with elementary children
2:45-3:00	break		
3:00-4:30	IS02	Belvedere	Invited Session 2: K Ann Renninger (organizer) Interest and its development: What data suggest and what still needs to be figured out
	SY04	Yerba Buena	Symposium 4: "A journey with Piaget": Explorations into learning develop teachers' understanding of teaching science and other areas
	SY05	Treasure	Symposium 5: Multiple representations or a focused few?: Linking conceptual and procedural understanding of mathematics concepts
	SY06	Angel	Symposium 6: Content Learning and Identity Construction (CLIC): An interpretive framework to strengthen African American students' mathematics and science learning in urban elementary schools
	DS01	Amador	Discussion 1: The growth and development of knowledge: Cultural genetic epistemology
	PS04	El Dorado	Paper Session 4: Higher Education
	PS05	Mariposa	Paper Session 5: Piagetian Theory II
4:30-4:45	break		
4:45-6:00	SY07	Belvedere	Symposium 7: Identifying and working with situational interest in science
	SY08	Yerba Buena	Symposium 8: Emotional competence and conduct
	SY09	Treasure	Symposium 9: The disappearance of moral norms in recent evolutionary and neuropsychological approaches to morality
	SY10	Angel	Symposium 10: Family conversations in informal settings: Varying support for children's science understanding
	PS06	Amador	Paper Session 6: Culture, Math, and Diversity
	PS07	El Dorado	Paper Session 7: Research applications of Piagetian theory
	PS08	Mariposa	Paper Session 8: Technology and Development
6:00-6:15	break		
6:15-6:45	PT01	Quarter Deck	Poster Session 1 (20 posters)
7:00-7:30	PT02	Quarter Deck	Poster Session 2 (20 posters)
6:30-7:30	REC1	Ballroom	President's Reception

Program Overview—Friday

Time	ID	Location	Event
8:00-9:00	FUND	Angel	Federal Funding: Research training and grant opportunities
	RT01	Amador	Round Table Session 1: Social Interaction and Development
	SY11	El Dorado	Symposium 11: Relations between language and Theory of Mind: Perspectives on social relationships, measurement, and disability
	RT02	Mariposa	Round Table Session 2: Science Education
9:00-10:30	SY12	Belvedere	Symposium 12: The power of leveraging microevolution to build young children's understanding of the mechanism of natural selection
	SY13	Yerba Buena	Symposium 13: How do cultural differences affect teaching and learning mathematics?
	SY14	Treasure	Symposium 14: Representational tools in problem solving
	DS02	Angel	Discussion Session 2: Disequilibrating our views on doubt: A discussion
	PS09	Amador	Paper Session 9: Epistemology and Science Learning
	PS10	El Dorado	Paper Session 10: Observing the Development of Mathematical Knowledge
	PS11	Mariposa	Paper Session 11: Moral and Social Development I
10:30-10:45	break		
10:45-12:00	PL03	Ballroom	Plenary Session 3: Reed Stevens The social lives of children: What a micro-ethnographic focus on children's interests and concerns can tell us about early STEM learning
12:00-1:15	Lunch		12:00-12:30 Member's Meeting – Ballroom
1:15-2:45	IS03	Belvedere	Invited Session 3: Gary Benenson (organizer) The development of design in mathematics and science
	SY15	Yerba Buena	Symposium15: Children's conceptions of science: Implications for education
	PS12	Treasure	Paper Session 12: Cognitive development, math, and science
	SY16	Angel	Symposium 16: Picturing objects in infancy and toddlerhood: Perceptual and conceptual developments in pictorial competence
	SY17	Amador	Symposium 17: Biases and awareness in numerical judgments: Dual processes in development
	PS13	El Dorado	Paper Session 13: Discourse in Science Education
	PS14	Mariposa	Paper Session 14: Designing for STEM teaching and learning
2:45-3:00	break		
3:00-4:15	PL04	Ballroom	Plenary Session 4: Andrea A diSessa How should we construe cultural diversity for the purposes of equitable education
4:15-4:30	break		
4:30-5:45	SY18	Belvedere	Symposium 18: A learning progression approach to the reconceptualization of matter in elementary school
	SY19	Yerba Buena	Symposium 19: Field studies of early learning: Home, school, and media
	SY20	Treasure	Symposium 20: What we know affects how we think: Belief and strategy in the development of reasoning
	SY21	Angel	Symposium 21: The dynamics of scaffolding
	SY22	Amador	Symposium 22: Cultural approaches to talking science
	PS15	El Dorado	Paper Session 15: Social Interaction and Development
	PS16	Mariposa	Paper Session 16: Topics in Science Learning
5:45-6:00	break		
6:00-6:30	PT03	Quarter Deck	Poster Session 3 (20 posters)
6:45-7:15	PT04	Quarter Deck	Poster Session 4 (20 posters)
6:30-7:30	REC2	Ballroom	Jacobs Foundation Reception for Emerging Scholars
7:30-8:30	MRES	Mariposa	Mentors Roundtable for Emerging Scholars

Program Overview—Saturday

Time	ID	Location	Event
8:00-9:00	RT03	Angel	Round Table Session 3: Childhood & Education
	PS17	Amador	Paper Session 17: Science education
	PS18	El Dorado	Paper Session 18: Math
	SY23	Mariposa	Symposium 23: The role of executive function in the development of children's prospective memory
9:00-10:30	IS04	Belvedere	Invited Session 4: Rogers Hall (organizer) Difference, culture, and distribution in mathematics and science learning
	SY24	Yerba Buena	Symposium 24: Science and math: Multiple approaches to teaching and learning
	SY25	Treasure	Symposium 25: Critical perspectives on learning progressions
	SY26	Angel	Symposium 26: Children's attributions and experiences of sociomoral emotion
	SY27	Amador	Symposium 27: Piaget's essential (and under-theorized) contribution to a democratic pedagogical theory
	PS19	El Dorado	Paper Session 19: Moral & Social Development II
	PS20	Mariposa	Paper Session 20: Language & Math Education
10:30-10:45	break		
10:45-12:00	PL05	Ballroom	Plenary Session 5: Deanna Kuhn The universal and the particular in scientific reasoning
12:00-1:15	Lunch		
12:00-1:15	BOD	Quarter Deck	Board of Directors Meeting
1:15-2:45	SY28	Belvedere	Symposium 28: Models, modeling, and naïve intuitive knowledge in science learning
	SY29	Yerba Buena	Symposium 29: Parental supports in informal learning environments: Developing children's scientific concepts and skills
	SY30	Treasure	Symposium 30: Good intentions, problematic epistemologies: Why common "supports" for science students hinder inquiry
	SY31	Angel	Symposium 31: Putting Piagetian theory back into children's mathematical reasoning
	SY32	Amador	Symposium 32: How children learn to think scientifically
	PS21	El Dorado	Paper Session 21: Math Development
	PS22	Mariposa	Paper Session 22: Reasoning, Computation, Femininity: An eclectic set
2:45-3:00	break		
3:00-4:30	IS05	Belvedere	Invited Session 5: Brian Reiser (organizer) Supporting modeling, explanation, and argumentation in elementary and middle school classrooms
	SY33	Yerba Buena	Symposium 33: Beyond false belief: Theory of Mind assessment and application among diverse ages and populations
	SY34	Treasure	Symposium 34: Brazilian children's views on space, time, property and school
	SY35	Angel	Symposium 35: Using hierarchical complexity to determine how smart animals are
	PS23	Amador	Paper Session 23: Language
	SY36	El Dorado	Symposium 36: Narrative practices and narrative doubts
	PS24	Mariposa	Paper Session 24: Early Social Cognition
4:30-4:45	break		
4:45-5:45	BOOK	Ballroom	Book Discussion Session

Thursday—A.M.

8:30-5:00 Registration .....Conference Desk

8:30-5:00 Book Display..... Lobby

9:00-9:15 OR Opening Remarks .....Islands Ballroom

Geoffrey Saxe (JPS President)
Richard Lehrer & Leona Schauble (Conference Organizers)

9:15-10:30 PL01 Plenary Session 1 .....Islands Ballroom

The emergence, reproduction, and change of collective representations and ideas: The study of small communities in New Guinea and the United States

Geoffrey Saxe (University of California – Berkeley)

Psychological studies of cognitive development are often conducted without regard for the interplay between the cognitive activities of individuals and the cultural histories of communities. In my talk, I illustrate a heuristic research framework that illuminates this interplay through studies drawn from two programs of work. The first illustration is drawn from my work with a remote Papua New Guinea group; I focus on the emergence, reproduction, and alteration of collective systems for number representation and systems for naming currency tokens in the community over an extended period of time. The second is drawn from work on mathematics in upper elementary classroom communities in the United States where the focus is on number line representations to support rich understandings of integers and fractions

10:30-10:45 break

10:45-12:15 IS01 Invited Session 1.....Belvedere

Contrasting everyday and disciplinary cultures of argument in math and science

Organizer: William Sandoval (UCLA)

Sociocultural accounts of development have profoundly re-framed research on mathematics and science education over the last two decades, shifting pedagogical emphasis away from the acquisition of knowledge and skills toward a view of learning as an enculturation into disciplinary practices. From this view, knowledge and skills derive meaning by enabling participation in meaningful disciplinary activity. One such activity of both mathematics and science highlighted through this shift is argument: the coordination of claims about the world and evidence or other warrants that can justify those claims. At the same time, the sociocultural shift contrasts "everyday" and "disciplinary" cultures and implies a tension between them. We see an interesting contrast in cultural focus between mathematics and science education research on argument. In science education argument has been defined in specific ways as part of the epistemic culture of science, and research has focused on how to bring students' into that culture. In mathematics education there has been a productive focus on everyday mathematical reasoning that highlights how such reasoning is, in fact, already aligned with aspects of disciplinary practice. The aim of this symposium is to bring together these contrasting perspectives on culture and development, to promote a more thorough understanding of the development of mathematical and scientific argument, in school and out, as well as to encourage both science and mathematics education researchers to carefully consider the relations between everyday and disciplinary cultures.

The symposium includes two presentations of work in science education focused on helping students understand epistemic commitments common to science through engagement in arguments about what counts as a good claim, how claims can be tested through experiment, what makes a good experiment,

and so on. Then two presentations from mathematics education explicate how everyday mathematical sense making reflects implicit epistemic commitments about what counts as mathematics and the value of mathematics for reasoning about particular everyday situations. As a group, the presentations contrast various ways of conceptualizing argument and its role in meaningful cultural activity. In highlighting such contrasts, this symposium aims to generate ways to theorize and study how students understand and traverse multiple epistemic cultures, how everyday cultural resources can be brought to bear more fruitfully in mathematics and science education, and how disciplinary cultural resources learned in school can be made more valuable for everyday application.

Building a culture of argument in elementary school science
Noel Enyedy (University of California, Los Angeles)
Elizabeth Redman (University of California, Los Angeles)
William A Sandoval (University of California, Los Angeles)

Oppositional voice in scientific argumentation, reasoning, and learning
Michael Ford (University of Pittsburgh)

Argumentation as a strategic/mathematical and social process: The case of dominoes
Na'ilah Suad Nasir (UC Berkeley)

Justification in everyday mathematics: the proof is in the pudding
Shelley Goldman (Stanford University)
Roy Pea (Stanford University)
Kristin Pilner Blair (Stanford University)
Osvaldo Jimenez (Stanford University)
Christine Fairless (Stanford University)

10:45-12:15 SY01 Symposium Session 1 ..... Yerba Buena

Learning mathematics through representations: Integers, fractions, and the number line

Organizer: Maryl Gearhart (University of California, Berkeley)
Discussant: Richard Lehrer (Vanderbilt University)

This symposium is a presentation of findings from Learning Mathematics through Representations (LMR), a research and curriculum development project that focuses on the number line as the representational context for supporting children's understandings of integers and fractions. The symposium has four parts.

Part 1 provides an overview of the mathematics and the two coordinated strands of the project, developmental research and curriculum design. Curriculum design frames research questions for investigation of student thinking and learning related to the representation of rational numbers on the number lines. Developmental research guides the design of tasks that support student insight and the design of pedagogical techniques that help teachers build on student thinking in classroom discussions.

Part 2 illustrates findings from the developmental research component. Interview studies have focused on students' thinking about ideas related to integers and fractions on number lines, and tutorial studies have identified conceptual and representational hurdles as students work through potential targets for instruction with guidance from tutors. Findings show that fifth grade students are challenged in their efforts to coordinate numeric and geometric units on the number line, but two resources support the development of new insights: analogies between the number line and an everyday measurement context (a 'race course'), and the explicit co-construction of number line principles (such as 'order' and 'unit') that then serve as resources for reasoning about the placement of numbers on the line.

Part 3 features the LMR curriculum design, including findings from formative studies, and an outline of the current experimental study. LMR lessons begin with non-routine "Problems of the Day" that create a context for intellectual disagreement and uncertainty; the teacher guides the class toward partial resolution through the co-construction of Principles and Definitions that serve as a shared resource for argumentation that shifts authority for knowledge from the teacher to the mathematics. This segment includes posters that illustrate lessons and engage the audience in interaction with researchers and collaborating teachers.

Part 4 features analysis and commentary by a scholar in the development of mathematical and scientific reasoning, and the design of instructional strategies.

Part 1: Interplay between curriculum development and foundational research
Geoffrey B Saxe (University of California, Berkeley)

Part 2: Foundational developmental research: Illustrative interview and tutorial studies

Students' strategies for coordinating numerical and linear units on the number line
Meghan Shaughnessy (University of Michigan)

Strategies for Supporting Generative Thinking about the Integer Number Line
Darrell Earnest (University of California, Berkeley)
Yasmin Sitabkhan (University of California, Berkeley)

Part 3: LMR Curriculum design, classroom studies, and experimental study

Curriculum and materials design
Maryl Gearhart (University of California, Berkeley)
Katherine Lewis (University of California, Berkeley)

Classroom studies: Preliminary evidence of curriculum impact
Ronli Diakow (University of California, Berkeley)

Sample lessons (interactive posters)
LMR team members, including collaborating teachers

Evaluation study
Geoffrey B Saxe (University of California, Berkeley)

Part 4: Discussion
Richard Lehrer (Vanderbilt University)

10:45-12:15 SY02 Symposium Session 2 ..... Treasure

"Sugar and spice" and/or "puppy-dogs' tails": The sociogenesis of gender during early childhood

Organizer: Emma Baumgartner (University of Rome)
Organizer: F Francis Strayer (University of Bordeaux 2)
Discussant: Marcel Trudel (Université de Sherbrooke)

Questions about the nature and functions of peer relations have been persistent themes in psychological accounts of human development (Baldwin, 1897; Parten, 1932; Maccoby, 1988). Socialization with peers provides occasions for joint construction of interpersonal standards, collective norms and more general social conventions. Together these occasions shape and constrain children's adaptation within their stable social settings (Youniss, 1980; Rocher, 1992). Peer interaction provides opportunities

for coordinated joint action as well as socio-cognitive conflict leading to the acquisition of enhanced negotiation skills (Baumgartner & Strayer, 2008). Eleanor Maccoby (1988) argued that throughout early childhood, play with peers occurs largely within same-sex settings, and suggested that gender specific play styles and modes of exerting peer influence are important factors underlying same-sex social preferences. Examining three classes of potential explanatory processes (biological factors, early socialization, and gender concepts), she concluded that masculinity and femininity, as dimensions of individual differences, may not be linked to preference for same-sex playmates, and that these two aspects of sex typing may require different explanations. "Segregation is depicted as a group phenomenon, essentially unrelated to individual attributes of the children who make up all-girl or all-boy groups. Concepts of gender identity and core categorical membership are seen as the primary cognitive underpinnings for sexual segregation" (Maccoby, 1988, p. *755*). Although research inspired by her review has furnished new information about each of these proposed underlying factors, there has been considerably less systematic effort to articulate a developmental model integrating all three of these explanatory levels. Contemporary approaches generally emphasize either a "biological" or an "experiential" model in efforts to address underlying determinants of either sexual segregation and or gender identity. In general, such models fail to consider the emergent nature of gender as a sociogenetic process, and consequently neglect the reciprocal causality inherent within dynamic action systems that constitute social adaptation. Implicitly, these studies become victims of the classic "nativist" - "empiricist" debate and fail to recognize emergent knowledge as a product of an action based approach to adapting systems (Allen & Birkhart, in press). This symposium examines observed differences in social adaptation and sexual segregation within early peer groups as factors that jointly shape both preschool and primary school children's emerging understanding of the "engendered self".

Origins of gender differences during the preschool years
Teresa Blicharski (University of Toulouse 2)
F Francis Strayer (University of Bordeaux 2)

Gender differences in social influence and social representation in preschool children
F Francis Strayer (University of Bordeaux 2)
Marie-Laurence Bon (University of Bordeaux 2)

Gender biases in young children's peer acceptance
Stefania Sette (University of Rome)
Corinna Gasparini (University of Rome)
Emma Baumgartner (University of Rome)

Social regulation of self-representation during the early primary school years
Judith Rousse (University of Bordeaux 2)
Sofia Desouza-Hue (University of Bordeaux 2)

10:45-12:15 SY03 Symposium Session 3 ..... Angel

Cognitive aspects of mathematical learning

Organizer: Darcy Hallett (Memorial University)

Math is a topic that is notoriously difficult to learn. Although there are many different factors that influence this process, the papers in this symposium approach this problem by examining the role that different aspects of cognition play in learning this difficult topic. The papers cut across different areas of mathematical learning, as two are related to fractions and ratios, two are related to the understanding of inversion (one in addition and subtraction, the other in multiplication and division), and one paper

concerns math anxiety. At the same time, they also cover different aspects of cognition, as two papers investigate the role of conceptual approaches and procedural approaches to learning, one examines how concepts can best be communicated, one considers the role of inhibition, while the other examines basic numerical skills.

In the first paper, Bryant and his colleagues investigate the learning of intensive quantities, which are quantities that are not defined by a single number, but by a proportional relation between two numbers. Using an intervention design, this research tests whether describing extensive quantities as either ratios or fractions can help young children learn this concept. The second paper also concerns children's understanding of fractions, but instead focuses on the conceptual and procedural aspects of this understanding. More specifically, Hallett and his colleagues use cluster analysis to examine the different patterns of conceptual and procedural knowledge that is exhibited in fraction understanding and how this understanding changes longitudinally. In the third paper, by contrast, Barros and her colleagues consider conceptual and procedural approaches to the understanding of the concept of inversion. Their results illustrate a divide in how children can be taught to approach problems either relationally or numerically. The fourth paper also explores children's understanding of inversion. In this paper, however, Robinson and Dubé also consider how factual knowledge and inhibition are related to the understanding of inversion. In the last paper, Maloney adds some variety by examining the topic of math anxiety, but interestingly investigates how math anxious people may have problems not only in anxiety, but also in basic numerical skills. As a collective, all of these papers offer both a varied but a complementary insight into mathematical cognition, and how this understanding can enhance the way that we teach mathematics.

Intensive quantities: Using ratio vs. fractional representation

Peter Bryant (Oxford University)
Daniel Bell (Oxford University)
Rossana Barros (Oxford University)

Developing profiles of conceptual and procedural knowledge in fractions from Grade 6 to Grade 8

Darcy Hallett (Memorial University)
Peter W Smith (Memorial University)
Meagan White (Memorial University)
Catherine Snow (Memorial University)

Teaching children how to include the inversion principle in their reasoning about quantitative relations

Rossana Barros (Oxford University)
Terezinha Nunes (Oxford University)
Deborah Evans (Oxford University)

Children's understanding of multiplicative concepts: Factual knowledge, inhibition, and transfer

Katherine M Robinson (University of Regina)
Adam K Dubé (University of Regina)

The relation between math anxiety and basic numerical processing deficits

Erin Maloney (University of Waterloo)

10:45-12:15 PS01 Paper Session 1 ..... Amador

Piagetian Theory I

Chair: Mark Bickhard (Lehigh University)

Transitive reasoning: A paradox resolved?

Barlow Wright (Brunel University)

Deductive-Transitive Reasoning (inferring A>C from the information A>B plus B>C), lays at the heart of things from understanding mathematical measurement to ranking ones-self in social contexts. Piaget maintained it is adult-like by 7-8 years. But Bryant and Trabasso dismissed his (3-term) research paradigm, replacing it with a new Extensive-Training Paradigm. This introduced intensive training, controlled for memory and increased transitive-series to 5-terms. Children now demonstrated transitivity at 4 years, signaling the downfall of Piagetian theory. This finding and paradigm have been applied to research concerning developmental learning difficulties, reasoning in non-humans, computational-modeling, brain structures underpinning transitivity, and even effects of mental disorders like schizophrenia on rationality. But the new paradigm was never assessed in terms of whether it really indexes the deductive-transitive capacity it targeted. Nor were grounds for rejecting the Piagetian paradigm empirically assessed. Here, we present research findings on both issues. We find the Piagetian deductive-transitivity age estimate was actually correct, irrespective of one's view of his theory. The lower estimate and associated extensive-training paradigm are unsafe for validly indexing the transitive capacity targeted. However, we show it is possible to accommodate both paradigms and both age estimates, if we apply a dual-process conception of transitive reasoning.

Beyond mechanism and mysticism: Piaget's dialectal constructivism and the problem of emergence

Thomas R Bidell (Independent Scholar)

Myra Bookman (University of Colorado Denver)

How does something new come into existence? This is the philosophical problem of emergence. With respect to cognitive development, the problem of emergence traditionally has centered on how to explain concepts or cognitive structures that are more powerful and inclusive than the parts which compose them. Contrary to readings of Piaget as a formal structuralist like Levi-Strauss, Piaget's constructivism reveals a relational or dialectal model of emergence. Piaget rejects two reductionist conceptions of emergence in which relations are external to parts: a mechanism in which parts pre-exist relations, with new structures arising simply from an accumulation of parts; and a mysticism in which wholes somehow pre-exist parts, creating new structures when they "contact" reality. Piaget argues that "genesis without structure or structure without genesis" are not the only alternatives. Instead he offers a relational model in which parts are internally related and therefore inseparable from the relations which unite them. New structures emerge through a dialectic whereby tension among internal relations leads the human agent to coordinate existing internally related structures into new structures with new relations among the parts. Because the new relational whole is composed of prior relational wholes, it is necessarily more powerful and inclusive.

The theoretical basis of Piaget's stage of sensorimotor intelligence

Ulrich Müller (University of Victoria)

The accepted view in contemporary developmental psychology is that Piaget's theory of sensorimotor intelligence has been proven incorrect by empirical studies that show that infants are so much smarter than he had thought. Consequently, his theory of sensorimotor intelligence is of interest mostly for historical reasons, presumably with little to offer to current theories of infancy. In this paper, I will argue that, to

the contrary, Piaget's work on infant development still remains unparalleled in terms of its systematicity, and that contemporary theories of infant development would benefit from a renewed and more in-depth reading of Piaget's work on infancy. I will develop my argument by elaborating on the epistemological assumptions of Piaget's theory. Specifically, within Piaget's developmental epistemology, sensorimotor intelligence bridges biological and psychological development. Furthermore, Piaget's work on infancy addresses several fundamental epistemological questions such as the relation between structure and function, matter and form, cognition and affect, biology and cognition, and it presents a systematic theory of the process of signification, the structure of consciousness, the role of action and experience in development. I will briefly sketch Piaget's answer to these questions and illustrate how his answers are as original today as they more than 70 ago.

On the cultural support of "cognizance": The Lakatosian key to Piaget 3.0

Michael O Vertolli (York University)
Jeremy T Burman (York University)

This talk reports on the results of an attempt to understand an anomalous diagram included in a later, less well-known work by Jean Piaget: The Grasp of Consciousness (1974/1976). By situating this diagram in the historical development of Piaget's concept of "cognizance," and connecting it to the discussions of "Piaget 3.0" at the St. Louis meeting, a new perspective of Piaget's final works is made possible. Additional insights are also derived by tracing Piaget's language to the influence of Imre Lakatos, whose ideas were later discussed explicitly in Psychogenesis and the History of Science (Piaget & Garcia, 1983/1989). By highlighting this connection, a poorly-understood aspect of Piaget's new theory is clarified: the importance of cultural context. In short, for Piaget 3.0, the contents of new insights are shaped both by action (as is understood of Piaget 2.0) and by the context of implication in which those actions are carried out (Piaget & Garcia, 1987/1991). Thus, "reason" and "representation" – the cognitive structures of math and science, as well as the focus of Piaget's last investigation (completed by Henriques et al., 2004) – can be supported through the construction of contexts commensurable with the specific contents one is trying to teach.

Epistemic categories are necessary, but not innate: Piaget's response to Kant, 1925

Jeremy T Burman (York University)

It is now well known that Piaget's earliest training was in biology. But it is not so well known that his plans for a second doctorate were foiled when he succeeded to the chair of his "maître" in philosophy, Arnold Reymond, at Neuchâtel in 1925. Indeed, aside from the title of his proposed dissertation ("An essay on value judgements and biological method in the sciences of the mind"), very little remains of his first attempted foray into psychological topics. In his inaugural speech at Neuchâtel, however, we do see hints of his plans for this early project. We can also see anticipated many of his later studies—especially those on logic, time, space, causality, quantification, and classification. Why? These were "categories," for Kant, and provided the necessary foundations for experience. Piaget responded that although such categories were necessary, they could not be innate. His early work with children, and his examination of the history of science, suggested instead that knowledge is contingent. Yet, crucially, he also asked: "Does the child possess a specific mental structure such that its progressive transformation, through education, is comparable to a metamorphosis or even a series of metamorphoses?" (my trans of Piaget, 1925, p. 208).

10:45-12:15 PS02 Paper Session 2..... El Dorado

Executive Function and Social Development

Chair: Bryan Sokol (Saint Louis University)

Temperamental exuberance and risk-taking: The moderating role of executive function

Ayelet Lahat (University of Maryland)
Kathryn A Degnan (University of Maryland)
Lauren K White (University of Maryland)
Jennifer Martin McDermott (University of Massachusetts)
Heather A Henderson (University of Miami)
Carl W Lejuez (University of Maryland)
Nathan A Fox (University of Maryland)

Exuberant temperament, defined as a disposition to respond to novelty with positive affect and approach, has been linked to impulsivity and risk-taking (Fox et al., 2001). Additionally, executive function (EF) has been found to play a role in adolescent risk-taking (Casey & Somerville, 2010). Therefore, the aim of the current study was to examine the moderating role of EF on the link between exuberance and risk-taking behavior. Two hundred and ninety one infants were brought into the lab and exuberance measures were collected at 4, 9, 24, and 36 months of age. Assessment of EF, as reflected in attention shifting, was made at 48 months of age. Risk-taking propensity was obtained at 60 months of age. The results indicate that exuberance and attention shifting interact to predict risk-taking behavior, such that for low attention shifting, high exuberance was positively associated with high risk-taking propensity, whereas children high in exuberance with high attention shifting abilities did not show such propensity. These findings suggest that the ability to shift attention, likely affording a child with the ability to consider both positive and negative consequences, moderates the relation between exuberance and risk-taking.

Meta-analysis of children's performance on the Dimensional Change Card Sort: insights into the development of executive function in early childhood

Sabine Doebel (University of Minnesota)
Philip David Zelazo (University of Minnesota)

Remarkable development in executive function (EF) occurs between 3 and 5 years of age. Young children often have great difficulty exerting conscious control over their behavior, particularly in the presence of salient stimuli that cues a conflicting response, whereas older children are generally better able to direct their behavior adaptively. A widely used measure that demonstrates this phenomenon in a particularly clear and striking way is the Dimensional Change Card Sort (DCCS; Zelazo, 2006). The DCCS has been fruitfully used to investigate the nature of EF in early childhood and evaluate competing theoretical accounts. Specifically, various task manipulations have been implemented to further our understanding about what cognitive abilities may or may not be necessary for successful EF. We present a meta-analysis of the extant childhood EF literature using the DCCS, undertaken in an effort to systematically evaluate developmental patterns, and to gain precise insight into how classes of task manipulations affect or fail to affect performance, with the overarching goal of gaining further insight into the nature of the development of EF in early childhood. We discuss the results of the meta-analysis and the broader theoretical implications of our findings for research on EF.

Short term effect of a mediated reading program of infantile literature on development of emotional competencies

Enrique Riquelme (Universidad Católica de Temuco)
Felipe Munita (Universidad Católica de Temuco)
Ignacio Montero (Universidad Autónoma de Madrid)

Emotional competencies are considered protective factors against behavioral problems. In the same way, they have been associated with an adequate social and academic development. Early intervention means a greater chance of stability and development of these skills. However there are few programs addressing these aspects and evaluating their effectiveness in the short, medium or long term. Our research goal was to implement an early intervention program to the development of emotional competencies based on the mediated reading of infantile literature. Participants were 92 children between 6 and 8 years, whose conformed three given groups. To assess the impact of the program was implemented a quasi-experimental design with two control groups. All the groups -"Mediated reading", "Traditional reading" and "Silent reading"- were compared in measures of facial emotion recognition, empathy and emotional lability. The results indicated significant differences in all dimension, with the mediated reading group obtaining the best performance in all evaluated dimensions with significant differences with the silent reading group in all dimensions, and significant differences in empathy and emotional lability with the Traditional reading group. The work concludes by analyzing the outcomes and limitations of the implemented program.

Toddlers benefit from labeling on an executive function search task

Stephanie E Miller (University of North Carolina at Greensboro)
Stuart Marcovitch (University of North Carolina at Greensboro)

Executive function (EF) research with toddlers younger than 3 has not clearly addressed the influence of labeling on EF performance, despite evidence that labeling relevant stimuli improved older preschoolers' EF performance (e.g., Kirkham, Cruess, & Diamond, 2003). The present study assessed 2.5-year-old children's use of differential visual and labeling cues on an age appropriate computerized multistep multilocation search task. Children were assigned to one of four conditions that differed based on the availability of visual and labeling cues of the hiding location. Hiding locations were either: (a) not marked by a familiar picture nor given a distinct label, (b) marked by a familiar picture but not given a distinct label (c) marked by a familiar picture and labeled by the experimenter, or (d) marked by a familiar picture and labeled by the participant. The results provided evidence that 2.5-year-old children benefit from visual and labeling cues in an EF task and that performance improved as the level of visual and linguistic support increased.

Executive function and the bilingual experience in preschoolers

Sarah Hutchison (University of Victoria)

An emerging topic in cognitive development is whether being bilingual constitutes an advantage in children's performance on executive function (EF) tasks. The purpose of this study was to compare the performance of EF tasks in English monolingual children and German-English bilingual children aged 3 to 6 years old. Fifty-six children completed tasks of short-term memory, working memory, inhibition, cognitive flexibility, and verbal ability. No significant difference was found between the performance of bilingual and monolingual children in EF tasks, even when level of language proficiency was taken into account. Limitation to the study and avenues for future research are presented.

10:45-12:15 PS03 Paper Session 3 ..... Mariposa

Theory of Mind

Chair: Sandra Bosacki (Brock University)

Role-play and the improvement of Theory of Mind in Singaporean preschoolers

Pinxiu Shen (Nanyang Technological University)
YingYing Long (Nanyang Technological University)
Ying Jia Yee (Nanyang Technological University)
Evangeline Shu Yi Wai (Nanyang Technological University)
Li Qu (Nanyang Technological University)

This study examines how role-play can improve preschoolers' development of Theory of Mind (ToM). Thirty-four Singaporean 4- to 6-year-olds who did not pass knowledge-ignorance, explicit false belief, content false belief, or belief emotion task were randomly assigned to training or control condition, each of which included three 50-minute sessions. In the training condition, children were told stories and were asked to role-play the characters. In the control condition, children engaged in coloring activities. Additionally, children were administered both pre- and post-intervention tests, including the above four ToM tasks, and tasks of vocabulary, working memory, and executive function. Results indicated that although children in the two conditions did not differ from each other on the pre-intervention tests, during the post-intervention test, the children in the training condition outperformed those in the control condition on belief emotion task. Compared to pre-intervention, the children in the training condition performed significantly better on content false belief task during post-intervention. Children's improvement on the ToM tasks was significantly correlated with their verbal ability and working memory. These indicate that role-play can improve the development of ToM in preschoolers and suggest that representation, language, and working memory are essential for the understanding of mental states.

Who wants and who knows? Inferring others' desires and knowledge via eye gazing and facial expression in Singaporean children, young adults, and elderly adults

Li Qu (Nanyang Technological University)

The current study investigated how people use eye gazing and facial expression to infer others' desires and knowledge. In particular, Study 1 examined how these abilities are related to the general ability of theory of mind, and Study 2 examined how these abilities develop across the life span. In Study 1, 59 Singaporean undergraduates (M age = 21.2) were administrated with the computerized "Who wants" and "Who knows" games, together with false belief location tasks (Baron-Cohen, 1989; Happé, 1994; Wimmer & Perner, 1983), the reading the mind in the eyes and in the face task (Baron-Cohen et al., 2001), and the strange stories and physical stories task (Happé, 1994). In Study 2, 125 Singaporeans (41 children: M age = 7.07; 45 young adults: M age = 20.89, and 39 elderly adults: M age = 62.03) had the two computerized "Who wants" and "Who knows" games. The results indicate that eye-gazing and smiling faces are essential cues in interpreting mental states. In particular, compared to elderly adults, young adults more often rely on eye-gazing in inferring others' desires, and children more often rely on eye-gazing in inferring others' knowledge.

Theory of mind in primary school: results and methodological implications

Julie Melancon (Université du Québec à Rimouski)
Helene Ziarko (Université Laval)

Many studies have demonstrated the development of a theory of mind (TOM) in children between the ages of 3 and 6 years old. But few have explored how these metarepresentational abilities evolve later

(Perner, 1999). To evaluate how the metarepresentational abilities of TOM progress over age 6, in the beginning of primary school, two studies will be presented. Study 1 is a longitudinal study that examines TOM development in French-speaking children from kindergarten to 1st grade. Results supported that TOM development does not reach the upper limit at age 7. In particular, aside classic First-order false belief attribution tasks, performances at an Explicit false belief first-order task, a Second-order false belief task, and the analysis of the subject's ability to justify a protagonist's action revealed the importance of mastering mental states and manipulate higher-order explicit representations beyond the age of 6. In the study 2, new TOM measurements will be proposed to 6, 7 and 8 years old children in a transversal study to examine the progression of metarepresentational abilities in the beginning of primary school. Preliminary results of the study 2 will be exposed and compared with the observations of study 1, and methodological considerations will be discussed.

The effects of mindfulness meditation-based interventions in early childhood

Kristen E Lyons (University of Minnesota)
Anna E Johnson (University of Minnesota)
Philip D Zelazo (University of Minnesota)

Mindfulness meditation entails purposefully attending to one's moment-to-moment experiences in a nonjudgmental and nonreactive way. Thus, mindfulness practice may be thought of as an attentional training regimen that promotes focused reflection on one's current experience and awareness of one's mental activity. A growing body of research indicates that mindfulness training may modify attention networks, emotional reactivity, and self-perceptions in adults, contributing to increased cognitive, emotional, and behavioral control. Preliminary research with older children and adolescents suggests that mindfulness may have beneficial effects for children as well, but experimental evidence for the efficacy of mindfulness-based interventions in children is sparse, especially with regard to early childhood. This presentation will provide a theoretical review of the mechanisms through which mindfulness practice may facilitate positive cognitive and socio-emotional outcomes in young children, as well as the results of a mindfulness-based intervention study with preschool-aged children (N = 20). Results indicate that mindfulness-based interventions are feasible to administer to small groups of preschool-aged children and that such practices result in improvements in executive function and social perspective taking.

Thursday—P.M.

12:15-1:30 Lunch

1:30-2:45 PL02 Plenary Session 2 ..... Ballroom

Investigations of text, talk, and activity in supporting scientific literacy with elementary children

Annemarie Sullivan Palincsar (University of Michigan)

Guided inquiry science teaching provides a rich – and complex – context in which to study children's sense-making regarding real world phenomena and the practices that scientists use to make claims about those phenomena. This presentation will focus on research that examined closely the pedagogical practices of three teachers who engaged 4th grade students in: either first-hand investigations of mass and motion on inclined and horizontal planes, second-hand investigations in which the children inquired with the use of a scientist's notebook documenting her studies of mass and motion, or a condition in which first- and second-hand investigations were in interplay. The focus will be on the scientific literacy practices in which the students engaged and how teachers' practices provided differential opportunities to develop scientific literacy.

2:45-3:00 break

3:00-4:30 IS02 Invited Session 2..... Belvedere

Interest and its development: What data suggest and what still needs to be figured out

Moderator: K Ann Renninger (Swarthmore College)

As a psychological variable, interest has a long history. In the late nineteenth and early twentieth century, interest was referenced in the work of Baldwin (1897), Dewey (1913), James (1890), Piaget (1940), and Thorndike (1935) among others. However, it is only in the last thirty years that studies of interest have been systematically undertaken. Research has demonstrated that interest is a critical cognitive and affective motivational variable that guides attention, facilitates learning across content areas and ages, and develops through experience. Investigations further suggest that interest has a reciprocal relation with other motivational variables such as goals, self-efficacy, and achievement value. While the way in which interest is generated and/or its effect on learning have been found to vary depending on the developmental phase of interest examined, clarity about how interest develops from one to another phase of interest is less well understood.

Session discussion will build on Hidi and Renninger's (2006) Four-Phase Model of Interest Development, a model informed by the research literature in which interest is conceptualized as both a state and a predisposition to return to particular engagement over time. Following an overview of the model, session participants will review studies from their research programs and use these to elaborate upon the phases of interest and the process of interest development. They will also identify open questions and describe how they are or might imagine addressing these. Following this, the audience will be invited to think with the presenters about what the data suggest and what still needs to be figured out.

The presenters each have developed research programs that focus on the role of interest development in science and math (although some have undertaken studies in other contexts as well). They employ different methods (Barron employs video, ethnography, and interviews, Durik uses experimental methods, and Renninger combines qualitative and experimental methods in naturally occurring contexts)– methods that warrant enough presentation time that they can be considered in relation to the questions of the session and corresponding findings. Their data allow consideration of interest and its development both in and out-of-school, and in terms of participants who vary in age, gender, experience, race, and SES.

Doing it: The expression of interest as behavior
Amanda M Durik (Northern Illinois University)

Ecologies of engagement: How places, purposes, and people support the development of interest
Brigid Barron (Stanford University)

Phases of interest, learning, and development
K Ann Renninger (Swarthmore College)

3:00-4:30 SY04 Symposium Session 4.....Yerba Buena

"A journey with Piaget": Explorations into learning develop teachers' understanding of teaching science and other areas

Organizer: Elizabeth Cavicchi (MIT)

How can teachers grow in their responsiveness to learning as a process of development? Most teacher training programs partition instructional content from pedagogical methods. That partitioning tends to diminish the access that teachers might have to the developmental character of learning. The presenters conduct educational experiences for teachers where content and pedagogy are integrated, and development is observable to these teachers in their own learning and in that of others. The pedagogy underlying these experiences is critical exploration. Eleanor Duckworth developed this research pedagogy from the demonstrations by Piaget and Inhelder that learning is exploratory and developmental.

As learners in the presenters' classrooms, teachers are immersed in exploring complex materials related to their subject content, reflecting on their learning and conducting similar experiences for others. Because the subject matter unfolds in the course of these explorations, its distinctive features and possibilities integrate with pedagogic decisions and classroom experiences. While participating teachers pursue personal questions about the content, their understanding of how they learn develops. Viewing anew their role as teachers, they find themselves concerned to follow the learning of their students as it develops. They observe keenly in the classroom. To become more perceptive of diverse evidences of students' development, they enrich opportunities for students to explore and reflect.

Science poses particular opportunities and challenges for exploratory teaching and learning. An opportunity lies in how readily science materials invite interactive exploration and offer immediate yet confounding feedback to a learner's interventions. A challenge lies in a perceived conflict between many learners' expectation that science provides definitive answers about nature, and the absence of such science answers from experiences that are fundamentally exploratory. Rauchwerk shares the struggles of dissenting voices whose demand for answers displaces their curiosity and explorative potential. Schneier and Shorr present contrasting explorations in other areas. Schneier's teacher education students probed what an object of study had to have, in order to generate investigative responses from learners. To prepare explorations on social crises for children, new teachers in Shorr's classroom must confront deep social complexities for themselves. While exploring science phenomena in Cavicchi's lab seminar, teachers discern analogies to the original explorations of historical scientists and envision new possibilities for their future teaching.

The transformation in understanding teaching that one schoolteacher experienced, while participating in McDonnell's exploratory classroom, provoked her to describe herself as being on a "journey with Piaget." The presenters welcome your accompaniment in that journey.

Teaching, learning, and inquiry
Fiona McDonnell (Emmanuel College)

Exploring light and history: Developments in understanding teaching and learning
Elizabeth Cavicchi (MIT)

Sustaining the disengaged (the questions around the angry learners)
Susan Rauchwerk (Lesley College)

The teaching and learning of social crises: How and what i and my first graders should be learning about international sex trafficking
William Shorr (Wheelock College)

Moving from teachers' own learning experiences to their creation of exploratory experiences for students
Lisa Schneier (Harvard University)

3:00-4:30 SY05 Symposium Session 5 ..... Treasure

Multiple representations or a focused few?: Linking conceptual and procedural understanding of mathematics concepts

Organizer: Aki Murata (Stanford University)
Organizer: Yukari Okamoto (University of California, Santa Barbara)
Discussant: Karen Fuson (Northwestern University)

Literature discusses the importance of using multiple representations in mathematics teaching and learning. In the Principles and Standards for School Mathematics, the National Council of Teachers of Mathematics (NCTM) discusses how students learn to reason mathematically by experiencing multiple representations: they choose, analyze, and understand strengths and appropriateness of different representations (2000). By representing data and problem situations in multiple ways, students come to develop deeper understanding of mathematics (Brenner et al., 1997). In agreement with this approach, U.S. mathematics textbooks are typically filled with various representations. Lewis, Perry, Friedkin, & Baker (2010), in their analysis of instructional units on fractions across different textbooks, found that typical U.S. textbooks used 25 representations compared to 5 in typical Japanese textbooks. Although no one argues against the benefit of having multiple representations in instruction, is there a possibility that too many representations may actually draw student attention away from the core content? Students may not realize that multiple representations used to convey a particular mathematical concept are in fact linked to support the development of that concept. Instead, they may develop fragmented knowledge that does not allow them to flexibly move from one representation to another.

The proposed symposium will address this question by putting together different research studies. Common among the papers in this symposium is the examination of number lines as a key representational tool in promoting conceptual and procedural understanding of mathematics concepts. The papers range in topics from how number line representations are used in Japanese classrooms to student learning of integers using number lines to teachers' and experts' visual representations of fractions, including number lines. With the recent attention on mathematical drawings in the Common Core Standards, the topic is timely and important to the mathematics education community.

This will be a poster symposium to ensure focused discussion of the theme topic as well as individual interaction and discussion of each of the four papers. After the organizers give the brief overview of the symposium theme topic and the description of each study (15 minutes), the audience will visit the posters

(already set up in the room), where presenters will discuss their studies in detail and answer questions (45 minutes). The group will then come together for a focused discussion of the theme topic, where a discussant will comment on the papers/posters (15 minutes), followed by the interactive Q&A (15 minutes). [90 minutes total]

Development of a set of related representations across mathematics topics and grades to support connection building: The case of tape diagrams and number lines
Aki Murata (Stanford University)

Extending the number line to negatives: A look at first grade students' reasoning.
Laura Bofferding (Stanford University)

Teachers' representational knowledge of division of fractions
Vanessa Walker (University of California, Santa Barbara)
Ani Dzhidaryan (University of California, Santa Barbara)

Experts' representational knowledge of division of fractions
Ani Dzhidaryan (University of California, Santa Barbara)
Vanessa Walker (University of California, Santa Barbara)
Yukari Okamoto (University of California, Santa Barbara)

3:00-4:30 SY06 Symposium Session 6 ..... Angel

Content Learning and Identity Construction (CLIC): An interpretive framework to strengthen African American students' mathematics and science learning in urban elementary schools

Organizer: Maria Varelas (University of Illinois at Chicago)
Organizer: Danny B Martin (University of Illinois at Chicago)
Organizer: Justine M Kane (Wayne State University)
Discussant: Na'ilah Suad Nasir (University of California, Berkeley)

In this symposium, we present a theoretical framework that depicts possibilities for the ways in which identity construction and content learning shape each other in school and classroom contexts. Consistent with a sociocultural perspective, we argue that it is important to conceptualize learning not only as the development of concepts, processes, skills, and practices, but also as a process of identity construction. This perspective offers important potential benefits to researchers' understandings of how students' multiple identities co-develop with content learning, and how content learning can be improved. Given our disciplinary affiliations, we focus on two domains, mathematics and science, that have been traditionally considered "gatekeepers" for students of color in urban schools. We give particular attention to how the framework may be helpful in understanding knowledge and identity construction among African American children and attend specifically to three identities: disciplinary (as doers of mathematics and science), racial (as African Americans), and academic (as participants in academic tasks and classroom practices). The framework draws attention to the need for empirical exploration of ways in which these three identity-formation processes interact, diverge, and develop together along with content learning in classrooms. In the session, the three authors will (1) present the framework, situating it within existing literature and discussing how it partially emerged from the authors' own previous empirical work, (2) identify questions worth pursuing within this framework and illustrations of the kinds of understandings such a framework promotes and articulates, and (3) offer examples of constructs (e.g., competence, performance, regard, obedience, and authority) that may further articulate it. Finally, the discussant who studies how culture and race influence the learning, achievement, and educational experiences and

trajectories of African American and other non-dominant students in urban school and community settings will respond and offer her own insights into the framework.

3:00-4:30 DS01 Discussion Session 1 ..... Amador

The growth and development of knowledge: Cultural genetic epistemology

Organizer: David Henry Feldman (Tufts University)
Participants:
Michael Cole (University of California, San Diego)
Andrea diSessa (University of California, Berkeley)
Jerome A Feldman (University of California, Berkeley)

One of Piaget's lifelong goals was to better understand knowledge, how it comes into being and how it becomes established, organized and adaptive. His main approach was to study efforts of the developing child to construct knowledge with the hope that, at least in part, the process would be analogous to the historical process that took place for each discipline (Piaget & Garcia, 1989). As productive as this effort has been, it has encountered certain limitations and problems that have proved difficult to overcome. In particular, studying how new knowledge is constructed was a particularly challenging problem. As Piaget wrote: "The real problem is the creation of the new structures" (Bringuier, 1980, p. 40).

Instead of trying to further explore the process and sequence of construction of universal structures of mind, the project to be discussed examines the origins, history, and processes through which nonuniversal domains of knowledge are established. We label this research program "cultural genetic epistemology" as contrasted with Piaget's "genetic epistemology." For cultural genetic epistemology, the objects of study include all of the known domains established by human cultures (Cole, 1996; Feldman, 1988, 1994).

Preliminary findings will be reported on three domains (computer science, science curriculum, and ballet or another art form) as well as preliminary conceptualizations of the dimensions of domains that could be used as a common basis for empirical study. A long term goal of the project is to establish both common patterns to the creation and establishment of knowledge domains as well their unique "signatures," the qualities that make each domain a distinct form of knowledge.

Discussants representing the domains and the development of culture will assess the current state of the research program and provide guides for future efforts.

3:00-4:30 PS04 Paper Session 4..... El Dorado

Higher Education

Chair: Beverly Caswell (University of Toronto)

From batter to pancake: A case of refinement of student prior knowledge about limits

Aditya P Adiredja (University of California – Berkeley)

Previous studies on student understanding of limits in calculus have focused on static models of student misconceptions. The lack of accounts of the process by which students learn limits motivate the focus on student knowledge, the process of refinements and connections between different knowledge elements (diSessa, 1993). Microgenetic learning analysis (Schoenfeld et al., 1993) documents the micro-developments of different knowledge elements and their connections in a 20-minute video episode of one student grappling with limits. Through refinements of knowledge elements, including the Pancake metaphor for epsilon-delta proof and making connections between them, the student arrived at a more robust under-

standing of limits. This supports the idea that student prior knowledge can serve as a resource on which to build productive knowledge (Smith et al., 1993).

Teaching toward equity in mathematics through multiple contexts of professional learning

Beverly Caswell (University of Toronto)

This research is a qualitative grounded theory ethnographic study examining changes in urban Canadian elementary school teachers' conceptualizations of equity and approaches to pedagogy in their mathematics teaching through their involvement in multiple professional learning contexts. The study focuses on four major professional development (PD) efforts in which the five focal teachers participated over a year. Data sources include researcher observations, field notes, video-recordings of PD sessions and classroom mathematics teaching, as well as transcriptions of interviews. Data analysis revealed three main ideas that were adopted by focal teachers: 1) the importance of developing awareness of students and their communities; 2) teaching strategies to scaffold students' development of mathematical proficiency; and 3) strategies for structuring student-driven, inquiry-based learning for mathematics. The multiple contexts of professional learning presented contradictory messages. Thus, teachers took up some ideas and left others behind and sometimes took up ideas that served conflicting goals of education. Future studies of teacher PD should focus on the teacher's perspective and the role of any individual PD within the multiple contexts of professional learning in which teachers participate.

A subsumptive constraints account of explanation and learning: explaining drives discovery of patterns and generalizations

Joseph Jay Williams (University of California – Berkeley)
Tania Lombrozo (University of California – Berkeley)

Generating explanations has a significant impact on learning, fostering knowledge acquisition and understanding in adults and younger students and driving conceptual change in children. Less is known about the mechanisms by which explaining has these effects, and therefore when and for what types of knowledge explaining will be most effective, and which prompts to explain are most suitable for particular contexts. A subsumptive constraints account of explanation and learning is presented, drawing on subsumption and unification theories from philosophy of science about common properties of explanations targeted at "Why?" questions. The account proposes that attempting to explain constrains the way people reason and learn such that they are driven to discover underlying patterns and generalizations. Experiments on how people learn about categories and learn to predict others' behavior provide evidence for this account and also reveal an explanation impairment effect. Explaining does not simply produce an all-purpose benefit for learning, but selectively drives learning about patterns and regularities: this effect is often beneficial for learning about principles and generalizations, but can hurt learning when patterns are misleading. This work provides novel theoretical and empirical insight into when explaining will be especially effective, as well as when it will be counterproductive.

Using machine learning to examine learner's engineering expertise using speech, text, and sketch analysis

Marcelo Worsley (Stanford University)
Paulo Blikstein (Stanford University)

There continues to be a call for learning approaches that promote collaboration, creativity and innovation, as well as culturally-aware, constructivist approaches to STEM learning. Unfortunately, these skills tend to lie in direct opposition to forms of the most commonly used forms of assessment – national standardized tests. Though the education research field has recognized this discontinuity, we do not currently have the technology needed to holistically assess learning which is customized, and well-adapted

to the learners' culture. Accordingly, this study endeavors to fill that gap by presenting results from a multi-modal analysis of naturally derived student data. More specifically, we used student dialogue, and student drawing – two common artifacts in project-based, constructivist learning environments – to develop predictors for student expertise in the area of engineering design. By leveraging the tools of machine learning, natural language processing, speech analysis and sentiment extraction, we were able to identify a number of distinguishing factors of learners at different levels of expertise. As such, this study motivates continued work in this space, and the development of a new paradigm for assessing student knowledge construction.

Why early courses matter for design-focused engineering capstones

Brian A Danielak (University of Maryland)
Vanessa Svihla, (University of California, Berkeley)

Our work is a case study focused on design practice in undergraduate engineering. Treating design as inseparable from the work of engineering, we propose a trajectory for how some students develop and enact views of design practice. We analyze two distinct but thematically coherent streams of data, arguing that early course experiences can strongly color how students later come to treat design work. In one stream we follow "Michael," a freshman engineering student at a large public university. Michael develops practical strategies to cope with an engineering program that (to him) undervalues mathematical sense-making and subjugates conceptual reasoning beneath calculation. Our second data stream follows the activity patterns of a student team in a design capstone course at another large public university. For this team, there is a marked tension among its members between treating their task as a legitimate design project versus simply a schoolish exercise. Our analysis treats both streams—Michael and the design team—as bounding a single hybrid case. By interpreting across time, location, and learning context we consider how the team data prefigure the trajectory of Michael, and how Michael's experiences explain the interactions in the design team.

3:00-4:30 PS05 Paper Session 5 ..... Mariposa

Piagetian Theory II

Chair: Ulrich Müller (University of Victoria)

A view of creativity as learning

Jeanne Bamberger (University of California, Berkeley)

How can we disentangle the mythic quality of creativity from other acts of enlightenment, learning, discovery, development, invention, progress—a tangled thicket of everyday acts? We make distinctions as a way of organizing and making clear, holding steady, the multiplicity of "possibles" in our experience. But once distinctions are made and their objects accepted as common practice, deep learning and new knowledge often occur at moments when the boundaries of these distinctions become porous, allowing multiple meanings to collide and stumble over one another. I will illustrate with moments in the working processes of two young children as they construct a tune. I argue that confronting conflicts among their assumed distinctions, learning results when: a kind of thawing out of intuitive structures animates and coordinates the configurations that were hitherto more or less rigid despite their progressive articulation (Piaget, 1947/1976: 138-9) With boundaries and border crossings of assumed entities in contention … each detour leads to interactions that supplement the various points of view (Piaget op cit). In this process (if we are noticing), creativity as invention is no longer a mythic event but rather the outcome of deep learning.

Modal un-differentiation in children: In the case of modus ponens

Akira Nakagaki (Waseda University)

Modus Ponens (referred to as MP) is an inference schema which deduces a conclusion q from a major conditional premise If p, then q and a minor premise p (p and q denote a proposition). This schema is the most fundamental in propositional reasoning and generally believed to develop at latest at 5, 6 years old (Rumain, Connell and Braine, 1983). On the other hand, young children as well as schoolchildren have difficulty in differentiating necessity from possibility (Piaget, 1981-1983). This modal un-differentiation in children seems to be at odd with the early acquisition of MP, because real MP inference has to be made on the basis of logical necessity, not of possible association and therefore it ought to be acquired much later in development. Thus it was hypothesized that the early acquisition of MP confirmed by the previous research might be spurious. This study examined the validity of this hypothesis experimentally and confirmed that MP inference schema is acquired much later than it was previously thought and presumably beyond their reach even for the 5th graders. Finally the theoretical implication of this new finding was discussed in terms of major theories of propositional reasoning.

Algebraic structures for modeling student construction of rational number

Anderson Norton (Virginia Tech)

This presentation will demonstrate the usefulness of Piaget's structuralism in modeling students' constructions of rational number. We will focus on two psychological operations—splitting and units coordination—and their roles in supporting students' transition from initial conceptions of fractions toward complete understanding of rational number. As the simultaneous composition of partitioning and iterating, the construction of the splitting operation marks an important point in this transition. However, until students' can coordinate the three levels of units involved in iterating partitions of continuous wholes, students will lack a general conception for rational numbers—one that includes improper fractions. We rely on algebraic structures from formal mathematics to model students' psychological structures and to identify the roles splitting and units coordination play. The algebraic structure of a mathematical loop is useful for describing the psychological structure of splitting. The algebraic structure of a mathematical group is useful for describing the psychological structure that results when students begin coordinating three levels of fractional units. This latter structure is isomorphic to the rational numbers under multiplication.

Conservation in deaf children: A second look

Melissa Herzig (University of California, San Diego)
Carol Padden (University of California, San Diego)
Aaron Shield (University of Chicago)

Furth (1961) was the first to suggest that deaf children are ideal subjects for the study of conservation because they lack language, but are otherwise cognitively intact. In his studies, he reported that deaf children can respond correctly to questions about conservation, but they do so at a later age than hearing children, and they follow a different sequence in mastery of conservation. As part of a larger project to probe the role of spatial strategies in the development of scientific and mathematical concepts in signing deaf children, we tested 32 deaf children who are native or near-native signers of ASL ranging in age from 5 to 8 years old on conservation of liquid, length, mass and number. We find no significant age difference in achievement of conservation when compared to hearing children as reported in the literature. Our results demonstrate that deaf children do not constitute a single experimental population for purposes of studying cognitive development. The performance of signing deaf children who have native or early exposure to sign language demonstrate that a key variable for studies of cognitive development is early language experience, not solely hearing loss.

4:30-4:45 break

4:45-6:00 SY07 Symposium Session 7 ..... Belvedere

Identifying and working with situational interest in science

Organizer: Martina Nieswandt (Illinois Institute of Technology)
Discussant: K Ann Renninger (Swarthmore College)

The importance of interest to learning is widely accepted; though, understanding how the earlier phases of interest, forms of situational interest, are triggered and maintained, continues to be a critical question for educators. Various studies in different educational contexts have shown that group work and interaction with particular activities (e.g., puzzles, hands-on labs, computers) tend to trigger adolescents' situational interest, whereas meaningfulness and active involvement in tasks support maintained situational interest. However, situational interest is not always sustained suggesting the need for in-depth qualitative study of learner characteristics and the learning context.

This symposium purposefully included four use-inspired, qualitative studies addressing situational interest in various contexts: preservice teacher education, undergraduate science learning, and amateur astronomy. Based on research indicating that regular arousal of situational interest could lead to the development of ongoing individual Rothapfel, Archer and Palmer's study investigate d possible means to support elementary preservice teachers' development of interest for science. – Horowitz examined in her research with students enrolled in an Organic Chemistry course (1) whether a curricular intervention that included autonomy, suspense and personal relevance support a different form of student engagement, and (2) whether it could trigger and sustain interest. – Assuming that certain features of a learning situation arouse a person's interest regardless of personal preferences for the situation Nieswandt's study asked: (1) Do a series of laboratory activities, which are part of a required undergraduate analytic chemistry course, arouse students' situational interest? (2) If so, what stimuli promote situational interest and how does it develop throughout the semester? – Azevedo investigated how long-term practitioners of amateur astronomy (i.e., those with an individual interest in the hobby) take up new lines of work in their practices. Put differently, his goal is documenting and explaining how an incipient interest—i.e., something akin to a situational interest—emerges from the complex interactions between the individual and the practice, and eventually becomes a sustained form of activity.

The session's discussant Ann Renninger and the following discussion with presenters and the audience will focus on three major questions: (1) What does "situational interest" refer to, and how is it measured? (2) What are possible triggers for situational interest? Do they work for all participants in the same way? And (3) How might the development of situational interest be supported?

The role of situational interest in promoting individual interest in science
Jeanette Rothapfel (University of Newcastle)
Jennifer Archer (University of Newcastle)
David Palmer (University of Newcastle)

Triggering but not maintaining situational interest in organic chemistry
Gail Horowitz (City University of New York)

Stimulating and measuring situational interest among college students
Martina Nieswandt (Illinois Institute of Technology)

Situated interests and the development of well-developed interests
Flávio S Azevedo (University of Massachusetts)

4:45-6:00 SY08 Symposium Session 8 ..... Yerba Buena

Emotional competence and conduct

Organizer: Megan L McCall (Saint Louis University)
Organizer: Bryan W Sokol (Saint Louis University)
Discussant: Stuart I Hammond (Simon Fraser University)

Emotional competence is a complex psycho-social construct, beginning with children's empathic connectedness to others and evolving into more advanced forms of social cognition. On many accounts, emotional competence is linked to increased prosocial conduct (e.g., care for others) and decreased antisocial conduct (e.g., bullying). According to Saarni, for example, there are many facets to children's developing emotional competence, including the recognition of emotions in both oneself and others, understanding emotional communication, and coping with negative emotions. She also includes moral responsiveness as a central feature of emotional competence. As she remarks, "having emotional 'skills' divorced from a moral sense does not constitute a genuine emotional competence. Emotional competence entails 'doing the right thing'" (Saarni, 1997, p. 39). Contributors to this symposium will explore a variety of the facets that are constitutive of emotional competence. The first paper, by Kusto and Kuebli, examines the use of paper-and-pencil measures of empathy in research with children, focusing specifically on ways to better operationalize empathy and refine assessment strategies. The second paper, by McCall and Sokol, explores the relationship between children's self-reported prosociality and actual prosocial conduct using various experimental manipulations. While researchers have debated the accuracy of self-reports, the relationship between self-reported prosocial conduct and actual prosocial conduct has not been sufficiently explored in the developmental literature. Finally, the third paper by Makariev and colleagues reports a study that investigates five- to thirteen-year-olds' predictions and explanations for people's decisions, emotions, and thoughts in situations where personal desires conflict with another person's need for help.

Defining and measuring empathy of school-aged children
Accalia R Kusto (Saint Louis University)
Janet E Kuebli (Saint Louis University)

Predicting prosocial conduct: A comparison of self-report and experimental measures
Megan L McCall (Saint Louis University)
Bryan W Sokol (Saint Louis University)

Children's explanations for people's behaviors, emotions, and thoughts in morally challenging situations
Drika Weller Makariev (University of California, Davis)
Kristin Hansen Lagattuta (University of California, Davis)
Liat Sayfan (University of California, Davis)
Marvyn Arevalo-Avalos (University of California, Davis)
Amber Buckelew (University of California, Davis)
Evan Layher (University of California, Davis)
Roxanne Shaffer (University of California, Davis)

4:45-6:00 SY09 Symposium Session 9.....Treasure

The disappearance of moral norms in recent evolutionary and neuropsychological approaches to morality

Organizer: Ulrich Müller (University of Victoria)
Discussant: Charlie Lewis (Lancaster University)

In the tradition of Piaget and Kohlberg, moral judgments have been considered prescriptive, normative statements, with the person making these statements being obligated to provide a justification for these statements if called upon to do so. Essentially, Piaget and Kohlberg both argued that the process of moral judgment and justification is a largely rational process. Recently, this idea has come under attack from evolutionary and neuropsychological approaches to morality. Among others, it has been argued that moral judgments are based on intuitive "gut" reactions and that moral reasoning occurs only to satisfy social expectations. Another, related line of research reduces moral judgments to the activation of particular brain areas. The upshot of this neuropsychologist approach to morality is that human beings are puppets who are completely determined by the combined effects of genes and environment.

This symposium will examine and evaluate the challenges that recent neuropsychological and evolutionary approaches pose to classical theories of morality. The first paper by Boom focuses on Jonathan Haidt's work. Haidt debunks rational approaches to morality and presents a social intuitionist model, with a focus on intuitions and emotions, as alternative to classical theories of morality. Boom contrasts Haidt's approach with those of Kohlberg and Habermas and concludes that Haidt's theory of moral psychology makes an interesting and useful contribution to the question of how individual moral judgments are made, but fails to properly address the issue of how morality develops in the first place.

The second paper by Müller discusses the neuropsychological approach to morality, using the work by Joshua Greene as an example. Greene suggests that what we consider to be moral judgment is causally triggered by the activation of neuroanatomical structures. Müller argues that even though neuropsychological research contributes to the explanation of intra- and inter-individual differences in moral judgments, Greene's reductionist position ultimately falls short because it fails to account the normative nature of morality.

In the third paper, Carpendale argues that although moral norms are downplayed and reduced within current evolutionary and neuropsychological approaches, they still seem to be presupposed in, for example, our ability to recognize injustice. Accordingly, the approaches fail to make these phenomena intelligible. Carpendale suggests that a developmental approach is necessary to explain the emergence of moral norms. In this context, Carpendale draws on Piaget's work because the issue of how children construct moral norms was Piaget's primary problem.

From moral development to moral psychology
Jan Boom (University of Utrecht)

The contribution of neuropsychological approaches to understanding morality
Ulrich Müller (University of Victoria)

A Natural History of Moral Norms
Jeremy I M Carpendale (Simon Fraser University)

4:45-6:00 SY10 Symposium Session 10 ..... Angel

Family conversations in informal settings: Varying support for children's science understanding

Organizer: Maureen Callanan (University of California, Santa Cruz)
Discussant: William A Sandoval (UCLA)

Substantial research has shown that many children, even at a very young age, engage in discussions about science topics in everyday settings (e.g., Callanan & Oakes, 1992; Ochs & Taylor, 1992). For example, children ask their parents questions about natural phenomena in the world, and parents explain events while interacting with museum exhibits (e.g., Benjamin et al, 2010; Crowley et al, 2001). Yet children from different families are likely to experience conversations about science that are shaped by a range of individual and contextual factors (Gaskins, 2009; Tenenbaum & Callanan, 2008). We still know relatively little about this variation in children's exposure to science topics and practices in informal settings, or about its importance for children's science understanding. This symposium will explore several dimensions of variability in family conversations about science, focusing most closely on aspects of parents' and children's domain knowledge, and parents' attitudes toward science. Catherine Eberbach will discuss findings on parent and child generation of disciplinary talk during family visits to a botanical garden. She will explore parents' varying use of targeted questions, and how their use is connected to how children learn to observe the natural world more scientifically. Sasha Palmquist will discuss the structure and content of family conversations about ecological and evolutionary relationships in a dinosaur exhibition. She will focus on how parent-child talk varies depending on children's level of expertise in the dinosaur domain and consider the implications of these findings for how to support family disciplinary engagement in museum settings. Megan Luce (with colleagues Smilovic and Callanan) will discuss families' use of evidence in two studies: a study of parent-child conversations while reading a book about current science topics, and a study of family conversations in a museum exhibit focused on mammoth fossils. Luce will report on links among parents' varying attitudes about science, their style of conversation with their children, and their children's reasoning on a later evidence task. Our discussant, William Sandoval, a leading scholar in educating students about the nature of science, will comment on the presentations and how they fit into the larger landscape of science education. In particular, he will help us to consider whether children's everyday learning about science can be leveraged to support their understanding of more complex science concepts, how children's understanding of the nature of science develops outside of school settings, and how future research can help to answer these questions more fully.

Asking questions: Parents' role in supporting children's complex observations
Catherine Eberbach (Rutgers University)

Dinosaurs and disciplinary concepts: How knowledge shapes parent-child conversations
Sasha Palmquist (Institute for Learning Innovation)

Family conversations about evidence
Megan Luce (University of California, Santa Cruz)
Sarah Smilovic (University of California, Santa Cruz)
Maureen Callanan (University of California, Santa Cruz)

4:45-6:00 PS06 Paper Session 6..... Amador

Culture, Math, and Diversity

Chair: Linda M Platas (University of California, Berkeley)

Accommodating cultural and linguistic diversity in mathematics assessment: The Early Grades Mathematics Assessment in Sub-Saharan Africa

Wendi Ralaingita (RTI International)

This paper presents the challenges and possible solutions encountered in adapting an instrument to measure early mathematical competency across cultures and countries. Such assessments are frequently used to inform educational policy within countries, and contribute to the knowledge base used in decision-making processes for international donor organizations. Acquiring accurate information with a single assessment instrument has its advantages in that comparisons can then be made across districts, countries and regions. However, the design of such an instrument is challenging considering the cultural and linguistic diversity that abounds in regions such as Sub-Saharan Africa, Latin America and Southeast Asia. In this paper, discussion of adaptation within countries is framed by three theoretical strands: (1) the role of cultural practices in mathematical development; (2) linguistic modification, and (3) definitions of mathematical proficiency. This instrument, the Early Grades Mathematics Assessment, was piloted in several African countries, including Liberia, Kenya, Mali, Rwanda, Malawi, and the Democratic Republic of the Congo in 2009-2010. While measures of validity and reliability will be presented by country, adaptation to cultural and linguistic differences both within and between countries will be emphasized.

Economic exchanges: Young sellers' developing understandings of the worth of goods in Oaxaca, Mexico

Yasmin Sitabkhan (University of California, Berkeley)

The purpose of this paper is to shed light on the way that young children selling goods in Oaxaca, Mexico, mediate their understanding of the worth of a good through engagement in exchanges. This study builds from prior work investigating the mathematics developed through buying and selling practices, and aims to investigate how children evaluate the worth of a good in an exchange. Specifically, the study focuses on the character of the cultural artifacts (i.e. currency value of the good, qualities intrinsic to the good such as utility, esthetic, and source) children draw upon to mediate their understandings. Children between the ages of 7-15 (n=30) were observed as they conducted various exchanges, and then presented with various scenarios to elicit their understanding of the worth of a good. The findings demonstrate that a child's individual wants and needs are subordinated to currency values when evaluating the worth of a good. Intrinsic qualities of the good become coordinated with currency values in sellers' sales pitches to customers when engaging in economic exchanges.

Mathematical problem solving in religious practices: A study of tithing and context

Edd V Taylor (Northwestern University)

The purpose of this study was to examine children's mathematical understandings related to tithing (giving 10% of earnings to the church) in a religious community. Tithing is one of a small number of activities in which children determine appropriate quantities using rational numbers. This qualitative study included observations and interviews with church leaders and parents related to the context of children's tithing practices, and interviews of children from 15 families to capture the mathematics in which children are engaged through participation in the practice. This study documents the ways in which children's mathematical problem solving was related to the context of their religious practices. Children from this faith community solved multiple problems in and outside the context of church tithing practices (counter-

balanced for order). Children were more successful in the tithing context, and also provided responses much more advanced than would be expected given their age. Children in families with the greatest opportunities to tithe were also more likely to use different mathematical problem solving strategies between the two contexts.

How an African American cultural practice supports scientific modeling

Alfred R Schademan (California State University, Chico)

The purpose of this study is to examine the kinds of reasoning that African American young men learn and develop when playing Spades, a common cultural practice in African American communities. Using a sociocultural view of modeling, the qualitative study found that the Spades players routinely consider multiple variables and their mathematical relationships when making decisions. The variables considered by the players when bidding include card strength, the number of cards held in any particular suit, player bidding tendencies, player levels of expertise, the current score of the game, and the level of confidence in one's partner. The paper claims that the forms of reasoning explored in this study connect to those of scientists who engage in modeling. The study therefore highlights the significance of Spades as a cultural practice in which significant forms of reasoning have evolved. Further, the study identifies and explores the contextual factors that support the development of scientific and mathematical forms of reasoning. In short, Spades is an enjoyable, social, dynamic, and intellectually challenging cultural practice that involves risk-taking, competition and cooperation. Further, Spades is an empowering context, as the players use their resources in order to gain respect in a peer-based community.

Code switching as a resource for mathematical reasoning: Bilingual Latino/a students' using two languages during group mathematical discussions

William Zahner (University of California Santa Cruz)
Judit Moschkovich (University of California Santa Cruz)

In this paper we extend the analysis in Moschkovich (2007) using data from our research on bilingual students' peer discussions in mathematics classrooms to critically examine four hypotheses about why bilingual students switch between languages (i.e., code switch) during mathematical discussions. Research on bilingual children and adults has explored the cognitive consequences of bilingualism, and some research shows cognitive advantages for bilinguals (see for example, Bialystock, 2001). Also, numerous studies of Latino/a students in mathematics classrooms have noted that the use of multiple languages in a classroom (usually Spanish and English) is critical for bilingual students' opportunities to learn mathematics (Gutiérrez, 2002; Khisty, 1995; Moschkovich, 2002, 2007). This analysis uses a situated and sociocultural perspective (e.g., Moschkovich, 2002) and confirms Moschkovich's (2007) previous findings by showing how the use of two languages provided resources for bilingual students' mathematical reasoning and discussion. Using examples from our prior research on mathematical reasoning during group discussions, we argue that bilingual students' code switching was not indicative of linguistic or cognitive deficits and rather the bilingual students in our studies mixed Spanish and English to skillfully manage the social and cognitive demands of mathematical discussions with peers.

4:45-6:00 PS07 Paper Session 7 ..... El Dorado

Research Applications of Piagetian Theory

Chair: Keith Alward (Independent Scholar)

Cognitive level of development and mathematical fluency of first grade children

Zane Curtis Wubbena (Texas State University)

This study was designed to investigate the cognitive level of development and mathematical fluency of first grade children. A total of (N=100) 6- and 7-year-olds from two low socioeconomic level elementary schools participated in this study. Piaget's conservation-of-liquid task was administered to children to determine their cognitive level of development. The fixed factor was the between-subjects variable group, which included (n=50) conserving and (n=50) nonconserving children in the first grade. The research hypotheses were addressed by using a MANOVA with the two dependent variables addition fluency and subtraction fluency. A counterbalanced method was employed to administer two separate single-skill math fact probes for two minutes to measure addition and subtraction fluency. The results indicated a highly significant effect on addition fluency and subtraction fluency (both p's < .001) as a factor of conservation ability with neither addition nor subtraction having a substantial advantage over the other. The covariate of age had a separate effect on mathematical fluency above and beyond cognitive level of development. The covariates race and gender had no effect on fluency. As indicated in this study, cognitive level of development was not a grade-level-based designation; levels of cognitive development were characterized by different abilities in mathematical fluency

The development of 4-, 6-, and 8 year old children's liquid conservation concept formation

Eun Young Kim (Seoul National University)
Soon Hyung Yi (Seoul National University)

The purpose of this study was to investigate children's liquid conservation concept according to their ages and tasks. Major findings were as follows: First, in the water quantity conservation experiment, 6- and 8-year-old children showed higher levels of liquid conservation concept than 4-year-old children. Children showed higher performance in the distillation equipment task than in Piaget's task. There was an interaction effect between ages and tasks. Second, in the water boiling experiment, the task execution scores of children aged four and six were significantly lower than those of children aged eight. However, children's liquid conservation concept did not show a significant difference depending on tasks. In the water evaporation experiment, the task execution scores of children aged four and six were significantly lower than those of children aged eight, and the scores for the drying task were significantly higher than those for the water level change task. In the water condensation experiment, the task execution scores of children aged four were significantly lower than those of children aged six and eight, and the scores for the frozen water bottle task were significantly higher than those for the frozen coke bottle scores.

A fine-grained Piagetian model of a student's developing epistemology of science

Julia Svoboda (University of California, Davis)

In this paper we provide an analysis of epistemological development that draws on a case study of "Eve" over a two-year period that spans her transition from a fourth year undergraduate biology major to a graduate student. We present Eve's trajectory as a rich narrative that traces the epistemic and methodological dimensions of her emerging conceptions of the nature and structure of scientific practice. Our central argument, based on our analysis of interview and observational data, is that the patterns of Eve's epistemological development are best explained using a model of that draws heavily Piaget's ideas about the micro-level adaptive processes of assimilation and accommodation and the mediating role of

affect. We argue that the shifts in Eve's epistemological schema represent adaptations to her experiences with the scientific practices of experimentation and modeling mediated by her affective response to these experiences. We discuss the theoretical contributions of our work as well as the methodological and instructional implications of adopting this view of epistemological development, arguing that curricula that aim to influence students' understanding of the nature and practice of science should be long-term and reflective of the plurality of methodologies and epistemic goals of authentic scientific practice.

Pragmatic reasoning schemas in children's logical thinking

Kenji Oura (Waseda University)

Although Piaget's theory is one of the most important development theories in the 20th century, it is criticized by many researchers from several reasons and moreover it has often been seen as an obsolete idea since development of cognitive science. For example, pragmatic reasoning schemas by Chao & Cheng (2000) gave a contradictory result to Piaget's theory. However, is Piaget's theory meaningless? The author investigated validity of Piaget's theory by using two kinds of tasks about pragmatic reasoning schemas. Subjects were 20 kindergarten children, 27 second and third grade and 26 fifth and sixth grade of elementary school children. The first task was similar in quality to materials of Chao & Cheng (2000) which had scenarios with a reason to act. The second task also had scenarios with a reason to act, but the context was different from the first task in terms of daily custom. If there were pragmatic reasoning schemas for children, there should not be difference between two tasks. However, the results showed that there were statistical differences between two tasks of second and third graders and of fifth and sixth graders respectively, and that children did not use pragmatic reasoning schemas but used only daily custom.

Basis for an epistemology of international relations from a post-Piagetian perspective

Joel Angel Bravo Anduaga (IPN-CIECAS)
Carmen Patricia Rosas-Colin (IPN-CINVESTAV)
Luis Mauricio Rodríguez-Salazar (IPN-CIECAS)
Irma Liliana Cervantes Azuara (IPN-CIECAS)

The proposed work is an epistemological reflection about International Relations from Piaget's genetic epistemology, under his Circle of Sciences proposal. It describes the idea of the psycho-social space in International Relations (IR) as the study field of the Epistemology of the Imagination, from a Post-Piagetian view developed by the Research Group Nuovo Cimento. We introduce the possibility that the psycho-social spaces; spaces between individual and institutional level, may offer an enlarged epistemological alternative among the current study object of the International Relations. In this framework we present some examples in order to configure psycho-social spaces in the International Relations, among them Peace Missions implemented by the United Nations Organization. This new view for IR at the same time is useful for define the study object of our epistemological proposal: epistemology of imagination.

4:45-6:00 PS08 Paper Session 8 ..... Mariposa

Technology and Development

Chair: Dor Abrahamson (University of California, Berkeley)

Calculational versus mechanistic mathematics in propelling the development of physical knowledge

Eli M Silk (University of Pittsburgh)
Christian D Schunn (University of Pittsburgh)

A design experiment with a manipulation of instructional conditions across two groups of students was conducted to investigate the role of mathematics in solving problems involving a physical system. The instruction utilized a model-eliciting activity in the context of controlling robot movements. One group was encouraged to use mathematics as a calculational resource for being precise about numerical operations for transforming input values into desired output values. In contrast, the second group was encouraged to use mathematics as a mechanistic resource for describing their intuitive ideas about the physical quantities and their relationships. Both groups engaged in high levels of productive mathematical engagement, inventing, justifying, and evaluating valid strategies for controlling robot movements using mathematics. But only the mechanistic group made significant learning gains and were more likely to use their ideas on a transfer design task. Examples of the invented strategies and the talk about those strategies in whole class discussions suggest the students in the contrasting orientations thought about them in substantively different ways leading to differences in learning.

Exploring students' conceptions of global climate change: Reasoning about mechanisms and everyday human actions

Tammie Visintainer (University of California, Berkeley)
Vanessa Svihla (University of California, Berkeley)
Marcia Linn (University of California, Berkeley)

We explore the development of sixth grade students' ideas about the mechanisms associated with global climate change and their reasoning about the contribution of everyday human actions. We examine the impact of a seven-day inquiry unit that utilizes virtual experiments. We draw on pre and post-project interviews and written project responses to document the trajectories students follow in understanding the mechanisms associated with global climate change and making decisions about their own practices. From pre-project interviews, nine warming mechanisms, describing increases in temperature, and four energy-related mechanisms describing processes and outcomes associated with everyday energy use were identified. Some students made links between places where energy is created (e.g. power plants), processes (e.g. burning coal), and products (e.g. pollution), but cited a range of warming mechanisms indicating uncertainty about how pollution connects to warming. In post-project interviews, students integrated prior ideas about warming mechanisms with new ideas gained from virtual experimentation. Students displayed more sophisticated reasoning about the contribution of human actions to global climate change and made connections between warming and energy-related mechanisms. Some students reason about the practicality of their advice for how to lower energy use based on what they think people would be willing to change.

Computer-learner interaction: How careful design can scaffold learners

Melissa Kibrick (University of California, Irvine)
Lindsey Richland (University of California, Irvine)
Michael Martinez (University of California, Irvine)
Mark Bodner (Mind Research Institute)

Through careful maintenance of motivation, control of possible choices in problems, and presentation of effective problem solving methods, instructors can scaffold learning (Wood, Bruner, & Ross, 1976). With interactive software programs, tutors no longer need direct contact with learners to structure interactions with the object of study. ST Math is a successful mathematics educational software for K-5 students designed to leverage students' spatial reasoning skills through visual-spatial interactive games. This study describes the scaffolding ST Math designers included in their software to teach students the rules of the games. For the 370 levels in the ST Math second grade curriculum, only 17.8% of the levels contain a tutorial option, but 61.0% of these are located in the first level of a game. The tutorial breaks the game

rules into a series of user actions providing the basic cause and effect of the game. These tutorials allow the object of study, ST Math, to instruct students on the game rules without the presence and direct intervention of a tutor. The designer has created an tutorial that scaffolds the learner through their first experience with the rules of the game preparing them for the more complex math puzzles.

Playing video games that target understanding of inverse spatial relations facilitates reasoning about causal proportions in children

Susan M Rivera (University of California - Davis)
Ann Wakeley (University of California - Berkeley)
Jonas Langer (University of California - Berkeley)
Greg Niemeyer (University of California - Berkeley)
Eric Kaltman (University of California - Berkeley)
Pamela Gallego (University of California - Davis)

Proportional reasoning is a core cognitive ability that is central to the understanding of such things as arithmetic (e.g., fractional ratios) and physical relations (e.g., causal balancing relations between weight and distance). Between the ages of 11 to 13 years, there is a major shift from predominantly qualitative to increasingly quantitative proportional reasoning about both arithmetic and physical phenomena. In this study, we implemented an online computer-based video training game for systematically exposing children to the concept of an inverse relation between two variables. Across three different interactive, online game modules, children gain the opportunity to construct rectangular figures using increasingly quantitative processes. Children (mean age 11.88) played this game over three sessions, spaced one week apart. During the first and the last session we obtained assessments of their reasoning about physical quantity using several tasks including a balance apparatus. Our pilot work demonstrates that 83% of the participants showed a qualitative shift in their reasoning about the relation between weights and distance on the balance scale from the first (pre-training) session to the last (post-training) session, indicating that learning about spatial proportions (in this case, using an interactive video game) may induce advances in reasoning about causal proportions.

The ghost in the computer: Exploring the role of agency-attribution when learning in ghost controls

Jennifer Vonk (University of Southern Mississippi)
M D Rutherford (McMaster University)

Two experiments explored children's ability to learn from a computer model or "ghost control." In this ghost control, a list of pictures was displayed simultaneously on the touch-screen. At the start of the trial, the computer highlighted each picture in a specific serial order (e.g., A ~~B~~ ~~C~~). In Experiment 1 children were first trained on the task prior to testing. Immediately before testing, children were read one of three scripts: Agency-Attribution (e.g., 'this computer is alive'), Mechanical-Attribution (e.g., 'this is just a machine') or No-Attribution ("Watch the computer"). Following testing, all children were given a survey assessing agency-attribution. Children learned in all ghost conditions when compared to chance. However, only performance in the agency-attribution condition positively correlated with children's agency-attributions in the survey. A second experiment manipulated various cues associated with the perception of agency/animacy (e.g., Biro & Leslie, 2007) provided by the computer in the ghost condition. Results were consistent with prior studies showing that the more agency/animacy cues provided by the computer the more likely children were to make agency/animacy attributions and the more likely they were to vicariously learn from the computer.

Thursday—P.M.

6:00-6:15 break

6:15-6:45 PT01 Poster Session 1 .....Quarter Deck

Poster Session 1

Posters should be mounted in the Quarter Deck room Thursday morning, to allow viewing during the day. Authors will be present during the evening poster session (6:15–6:45). Posters should be removed at the end of the session (6:45).

1. *All my surfaces: Encouraging higher-order play through substance & realism*
   James D Morgante (University of California, Los Angeles)
2. *The development of storytelling in two languages with words and gestures*
   Elena Nicoladis (University of Alberta)
   Angélique Laurent (University of Alberta)
   Paula Marentette (University of Alberta)
3. *Triangulating validity evidence to explore the contexts of assessment*
   Kristen O'Rourke Burmester (UC – Berkeley)
4. *Integrating emotions in fine-grained accounts of students' reasoning*
   Ayush Gupta (University of Maryland)
   Andrew Elby (University of Maryland)
5. *Did you hear about Maimonides the Rabbi-Doctor? Teaching science through personal religious meaning*
   Gabriel Bukobza (Tel Aviv University)
6. *Do 4-year-old children understand the principle of PET bottle rocket? How?*
   Kinya Shimizu (Hiroshima University)
   Yumiko Suzuki (Hiroshima University)
7. *Cultural supports for scientific reasoning and critical computational literacy: case studies on the paradox of the culturally-aware curricula*
   Paulo Blikstein (Stanford University)
8. *Where understanding comes from: The case of natural numbers*
   Juan José Giraldo Huertas (Universidad de la Sabana)
   Francys Subiaul <subiaul@gwu.edu>
9. *Multiple imitation mechanisms in children*
   Francys Subiaul (The George Washington University)
   Sarah Anderson (The George Washington University)
   Janina Brandt (The George Washington University)
   Jenny Elkins (The George Washington University)
10. *"Skyping" with baby: Infants and emergent communication technologies*
    Emily Sutcliffe Cleveland (California State University, East Bay)
11. *Effects of counselor gender and problem type on attitudes towards seeking professional help*
    Hamide Gozu (State University of New York, at Albany)

12. *Fairness, or favoritism? Children's understanding of differential treatment by teachers*
    Marie Le (UC – Berkeley)
    Holly Recchia <hrecchia@education.concordia.ca>

13. *"I didn't mean to hurt her but I was just so mad": Children's and adolescents' narrative accounts of harming their younger siblings and friends*
    Holly E. Recchia (Concordia University)
    Cecilia Wainryb (University of Utah)
    Monisha Pasupathi (University of Utah)

14. *Relations between preschoolers' executive function and pretend play: Data from parent-report, observation, and experimental manipulation*
    Tamara Spiewak Toub (University of Washington)
    Stephanie M Carlson (University of Minnesota - Twin Cities)

15. *Young children prioritize preference over utility cues to make tool choices in problem-solving tasks*
    Sarah Bidmead (Florida Atlantic University)
    Marissa Greif (Florida Atlantic University)

16. *Navigating multiple cultural worlds: Exploring the processes and contexts of being differentially marked*
    Elizabeth Pufall Jones (Tufts University)

17. *Logico-mathematical structures development in elementary education children*
    Dora Elizabeth Granados Ramos (Universidad Veracruzana)
    Gabriela Romero Esquiliano (Universidad Autónoma Metropolitana Xochimilco)

18. *Societal/educational influences affect whether people consider alternative explanations*
    Barbara Koslowski (Cornell University)
    Jessica Sue-Wern P'ng (Cornell University)
    Jay Kim (Cornell University)

19. *Integrating cultural awareness and innovative practices for mathematics teacher professional development: A video-based project focused on student mistakes*
    Rossella Santagata (University of California, Irvine)
    Wendy Bray (Rollins College)

7:00-7:30 PT02 Poster Session 2 .....Quarter Deck

Poster Session 2

Posters should be mounted in the Quarter Deck room at the end of Poster Session 1 (6:45). Authors will be present during the evening poster session (7:00–7:30). Posters may remain mounted after the session to allow viewing the following morning. Posters should be removed during the lunch break on Friday.

1. *No and yes: On the development of head shaking and nodding in infancy*
   Becky Stewart (Simon Fraser University)

2. *A-not-B search in light vs. dark*
   Jeanne L Shinskey (University of London)
   Kate Ryan (University of London)
   Wing Yen Wong (University of London)

3. *Source memory in young children: Does self-generation at encoding make a difference?*
   Suzanne Hala (University of Calgary)
   Lee-Ann McKay (University of Calgary)
   Kim Tan-MacNeill (University of Calgary)
   Lisa Pascal (University of Calgary)
4. *The role of individual differences in social-contextual factors on preschoolers' emotional memory*
   Kristen Weede Alexander (California State University – Sacramento)
   Heidi V Mendenhall (California State University – Sacramento)
   Rebecca Bronstein (California State University – Sacramento)
5. *Variation in children's graphic portrayal of friendship across autism severity and mainstreaming*
   Saba Ayman-Nolley (Northeastern Illinois University)
   Resney Gugwor (Northeastern Illinois University)
   Ramon Viera (Northeastern Illinois University)
6. *Empathy in children with conduct problems and the mediating role of callous-unemotional traits*
   Joyce Lui (University of British Columbia)
   Tracy Cassels (University of British Columbia)
   Sadaf Lotfalian (University of British Columbia)
   Sophia Ongley (University of British Columbia)
7. *Ascribing internal states to non-human kinds: A comparison of Native American and European American authored children's books*
   Ananda Marin (Northwestern University)
   Megan Bang (American Indian Center of Chicago)
   Doug Medin (Northwestern University)
8. *Cortisol and temperament moderate children's play behavior in response to unfamiliar social situations*
   Aria Ghanaat (University of California – Davis)
   Jacob Nuselovici (Concordia University)
   Paul Hastings (University of California – Davis)
9. *Children's development of informal tools: The role of sociomathematical norms in shifting strategies for linear measurement*
   Bona Kang (University of California – Berkeley)
10. *Thinking aloud: Adolescents' logical reasoning on a reading task*
    Bridget A Franks (University of Florida)
    David J Therriault (University of Florida)
    Miriam I Buhr (University of Florida)
    Evelyn S Chiang (University of North Carolina at Asheville)
    Claire M Gonzalez (University of Florida)
    Heekyung K Kwon (University of Florida)
    Jenni L Schelble (University of Florida)
    Xuesong Wang (University of Florida)

11. *Social context, motivation and learning in an educational video game to teach middle school math*
    Bruce D Homer (The Graduate Center, CUNY)
    Jan L Plass (New York University)
    Paul A O'Keefe (New York University)
    Elizabeth O Hayward (New York University)
    Murphy Stein (New York University)

12. *Toddlers' word learning from third party interactions using infant- and adult- directed speech*
    Priya M Shimpi (Mills College)
    Nameera Akhtar (University of California, Santa Cruz)
    Jillian French (University of California, Santa Cruz)
    Bryan Fowler (Mills College)
    Shannon Fisherkeller (Mills College)
    Rosalie Odean (Mills College)
    Shannon O'Brien (Mills College)

13. *Preschoolers learning how stuff counts: The unitizing of non-cohesive substances*
    Yujia Li (Mount Holyoke College)
    Peggy Li (Harvard University)
    Susan Carey (Harvard University)

14. *The phenomenon of teaching for transfer: The case for mathematics instruction*
    Vanessa Rayner (Concordia University)

15. *Influences of the family environment and parent-child relationships on the executive functioning of children with ADHD*
    Valarie M Schroeder (Miami University)
    Michelle L Kelley (Old Dominion University)

16. *Types of ethnicity-based discrimination and implications on ethnic identity*
    Michelle Twali (University of Utah)
    Monisha Pasupathi (University of Utah)

17. *Scaffolding interactions in individual music lessons*
    W E (Elisa) Küpers (University of Groningen)
    P L C (Paul) van Geert (University of Groningen)

18. *Children's narrative accounts of helping and hurting their friends, and what they teach us about moral development*
    Stacia Bourne (University of Utah)
    Holly E Recchia (Concordia University)
    Cecilia Wainryb (University of Utah)

19. *The role of imitation in the development of infant pretense*
    Maria Legerstee (York University)
    Gabriela Markova (Academy of Sciences of the Czech Republic)

20. *Does numerical information help children in avoiding conjunction fallacy?*
    Francesca Chiesi (University of Florence)
    Caterina Primi (University of Florence)

Thursday—P.M.

6:30-7:30 REC1 President's Reception.....Islands Ballroom

President's Reception

All conference attendees are invited to join us as Jonas Langer and Willis F Overton are presented Jean Piaget Society Lifetime Achievement Awards. This award is presented in acknowledgement of a distinguished body of scientific work that has, over a lifetime career, contributed significantly to our understanding of cognitive development, and in acknowledgement of major and continuing contributions made to the growth and success of the Jean Piaget Society. Following the brief award presentation, there will be plenty of time for mingling with old friends and new acquaintances. Appetizers will be served and a cash bar will be available.

Friday—A.M.

8:00-9:00 FUND Federal Funding Session ..... Angel

Federal Funding: Research training and grant opportunities

Organizer: Kathy Mann Koepke (NICHD/NIH)

This presentation will highlight current federal training, career development, and research funding opportunities available to learning & cognition investigators. Program Directors representing the NIH, NSF, & Ed-IES will present an overview of relevant research funding opportunities at each agency, as well as a brief overview of the grant application, review, and funding processes, providing hints for successful grant writing along the way. Come learn how to advance your research with federal support!

Presenters:

Kathy Mann Koepke (National Institutes of Health)
Christina S Chhin (Institute of Education Sciences)
James Dietz (National Science Foundation)

8:00-9:00 RT01 Roundtable Session 1 ..... Amador

Social Interaction & Development

Chair: Larry Nucci (University of California – Berkeley)

Toward a Vygotskian approach to children's dreams
Adrian Medina-Liberty (UNAM)

Development of moral reasoning in young adolescents
Shole Amiri (University of Isfahan)
Azar Etesamypour-King (Community College of Baltimore County)

Using constant and average rate of change to make sense of varying rate of change: Secondary students' ways of reasoning
Heather L Johnson (University of Colorado – Denver)

Evolutionary thinking: Weaving stories from different perspectives
Jessica E Watkins (University of Maryland)
Chandra Turpen (University of Maryland)
Janet E Coffey (University of Maryland)

8:00-9:00 SY11 Symposium Session 11 ..... El Dorado

Relations between language and "Theory of Mind": Perspectives on social relationships, measurement, and disability

Organizer: Tiffany L Hutchins (University of Vermont)

The aim of this symposium is to explore the complex links between language and "theory of mind." The first paper (Frohlick, Carpendale, & Williams) critically reviews approaches to the study of language and false belief understanding, and explicates assumptions about the nature of language and mind underlying such research. It is argued that the development of children's understanding of human activity in psychological terms is best supported within cooperative relationships which facilitate mutual understanding. Researching this process requires identifying aspects of talk and interaction that indicate cooperative interaction. The second paper (Hutchins & Prelock) reports the findings of two studies examining the psychometric properties of a new measure: the Theory of Mind Inventory (ToMI). The ToMI was developed in

response to a need for a measure of "theory of mind" that is not complicated by cognitive and linguistic performance factors, and would be appropriate for younger and older typically developing children as well as individual from across the autism spectrum. The authors will report on the psychometric properties of this measure and discuss the utility of the ToMI as a research tool. The third paper (Plesa-Skwerer, Ammerman, & Tager-Flusberg) explores relations between children's "theory of mind" and their social-pragmatic and communicative behaviors in typically developing children and children with Williams Syndrome (WS). Findings suggest that "theory of mind" abilities and impairments in a sample of children with WS reflect a distinctive social phenotype that may be used to pinpoint specific areas of difficulty for this unusually socially-driven population. Implications for advancing our theoretical understanding of the complex relations between social understanding, language, and social behavior in atypical development are considered.

Links between language and social relationships in social cognitive development
Sherri Frohlick (Simon Fraser University)
Jeremy I M Carpendale (Simon Fraser University)
Melanie Williams (Simon Fraser University)

Measurement of 'theory of mind' that is not complicated by cognitive and linguistic performance factors: the psychometric evaluation of the Theory of Mind Inventory (ToMI)
Tiffany L Hutchins (University of Vermont)
Patricia A Prelock (University of Vermont)

Relations between social understanding, social-emotional responsiveness, and pragmatic language abilities in Williams Syndrome
Daniela Plesa-Skwerer (Boston University)
Emily Ammerman (Boston University)
Helen Tager-Flusberg (Boston University)

8:00-9:00 RT02 Roundtable Session 2 ..... Mariposa

Science Education

Chair: Ulrich Müller (University of Victoria)

Preschooler's reasoning about movements in the physical world: A close look at gears
Hebbah El-Moslimany (Rutgers, The State University of New Jersey)
Susan L Golbeck (Rutgers, The State University of New Jersey)

Using self-generated analogies in teaching of thermodynamics
Jesper Haglund (Linköping University)
Fredrik Jeppsson (Linköping University)

Developmental changes of the cognitive structure in learning physics
Hiroshi Maeda (Komazawa University)

Curious minds: Teaching science and technology in the class (grades 1-4)
Annemie Wetzels (Rijksuniversiteit Groningen)

9:00-10:30 SY12 Symposium Session 12.....Belvedere

The power of leveraging microevolution to build young children's understanding of the mechanism of natural selection

Organizer: Kathleen E Metz (UC Berkeley)
Discusssant: Joseph Campione (UC Berkeley)

The profound difficulties in understanding the mechanism of natural selection are reflected in the cognition literature and history of biology. Children and adults alike frequently reason teleologically. From preschool through adulthood, individuals manifest "biological essentialism," assuming a species is determined by a defining essence, while ignoring the within-species variation crucial to understanding natural selection. Indeed even biologists of earlier eras fell prey to these same misconceptions. Although less studied in the psychological literature, the historical literature has also identified interpretation of species' changes as progressing to better final form, rather than the survival value of the changes within the environment.

Given these substantial challenges, how and when is it strategic to begin teaching the mechanism of natural selection? The 1996 NRC Science Education Standards recommended that we begin teaching evolution in middle school, at this point introducing three big ideas: a) common ancestry of the millions of species alive today; b) biological evolution as accounting for this diversity; and c) the possibility of extinction. The current on-line AAAS Benchmarks (2010) recommends that while K-8 students should be taught "lines of evidence", not until high school are they ready to learn about evolution. Rather than delay instruction about natural selection until middle or even high school, we contend that it is both feasible and strategic to begin instruction in the primary grades at the system level of microevolution.

This symposium is designed around a research project, scaffolding second and third graders' understanding of the mechanism of natural selection at the system level of microevolution. The first paper considers why this is strategic, the learning progression designed to build this understanding, pedagogical design principles also guiding the intervention, and outcomes in terms of children's advancements on the learning progression. The second paper examines outcomes in terms of the nature and frequency of misconceptions reflected in pre- and post-tests, also comparing children's success with items at different time scales. The last two papers examine the instructional scaffolding, as reflected in enactment of the curriculum modules. The third paper identifies a key barrier emerging from the first cycle of instruction, describes an external representation designed to help children grapple with the difficulty, and analyzes how the tool is used in a subsequent round of instruction. The fourth paper examines a key activity structure near the end of each instructional module: taking up cases of microevolution (drawn from the biology research literature) as thought experiments.

A microevolution approach to the teaching of evolution in second and third grade
Kathleen E Metz (UC Berkeley)

Situations in microevolution as a context to reveal student understanding and overcome alternative conceptions
Uyen Ly (UC Berkeley)

The life spiral: Supporting students' understanding of microevolution with visual representations
Nicole Wong (UC Berkeley)

Microevolution thought experiments: Foregrounding generational thinking and narrative to support reasoning about natural selection
Stephanie Sisk-Hilton (San Francisco State University)
Eric Berson (UC Berkeley)

9:00-10:30 SY13 Symposium Session 13.....Yerba Buena

How do cultural differences affect teaching and learning mathematics?

Organizer: Yasuji Kojima (Hokkai-Gakuen University)
Discussant: Peter Bryant (Oxford University)

In Japan, elementary school teachers tend to appear to take a less active role, allowing their students to invent their own procedures for solving problems. And those problems are quite demanding, both procedurally and conceptually. Teacher, however, carefully design and arrange lessons so that students are likely to use procedures that have been learned just before in class. Most of Japanese teachers would agree that Japanese school mathematics has been strongly influenced by the emphasis of problem solving as a good practical application of reform mathematics.

As a result, Japanese structured problem solving was built on the sound base of emphasizing story problems in mathematics teaching and learning. Historically, Japanese mathematics teaching and learning has been focused on developing mathematical thinking skills by using a variety of story problems.

Although Japanese structured problem solving has been influenced by U.S. research on problem solving, it is not the same as the problem solving approach used in the U.S. In the U.S., problem solving is often viewed as an approach to develop problem-solving skills and strategies. Therefore, U.S. mathematics lessons employing the problem solving approach are usually focused on the process of solving a problem and not necessary focused on developing mathematical concepts and skills. These problem-solving lessons often end when each student finds out a solution to the problem.(Stigler and Hiebert, 1999)

A major question we would discuss in this symposium is like this. Why Japanese mathematic education in elementary schools could make for a powerful approach for developing mathematical concepts and skills? On the other hand, why upper grade schools can not?

Four presentations will be made in this symposium. First, it is on differences of notation in mathematical words and how they affect understanding mathematics. Second, it emphasizes how children develop more advanced mathematical knowledge through participation in cultural activities that reflect the cultural values and practices. Third, it argues that mathematics consist not only mathematic logic but also general logic which may be defined as cultural elements. Fourth, it treats Japanese traditional mathematics (Wasan) and discuss that they implicitly affect mathematics education in Japan today.

Does singular/plural marking in English influence the comprehension of number words?
Yuko Yamana (Akita University)

Young children's mathematical development in Japanese Preschool
Tomomi Sakakibara (Tokyo Gakugei University)

Mathematical knowledge and the Logics
Hiroshi Tsukimoto (Tokyo Denki University)

Japanese mathematics and education
Yasuji Kojima (Hokkai-Gakuen University)

9:00-10:30 SY14 Symposium Session 14.....Treasure

Representational tools in problem solving

Organizer: Eduardo Martí (Universitat de Barcelona)
Organizer: Bárbara M Brizuela (Tufts University)
Discussant: Edith Ackerman (MIT School of Architecture Design Lab)

Challenges in learning mathematics and science are not only conceptual, but also representational. In fact, students have to deal with a wide variety of representational forms when solving mathematics and science problems (Duval, 1995; Lemke, 1993). In the present symposium, four studies dealing with the understanding and use of representational tools are presented. In the first presentation we address a basic question: at which age and how can young children understand symbolically an additive representation of number. The results can be summarized as follows: 1) There is a clear gap between the capacity to discriminate a set of objects (under three) and the symbolic understanding of number representation (also under three); 2) there is a close relation between the capacity to evaluate (verbally or through gestures) the quantity of dots and the use of this information to regulate action; and 3) the symbolic understanding of additive number representation appears later than the symbolic understanding of spatial representation. In the second presentation, two cases of young children's (Kindergarten and second grade) exploration of a real-time graph of linear human motion are presented and discussed according to how it affects their own representations of movement. Results show how manipulating conventional representations can facilitate children's exploration and building of new understandings of the scientific phenomenon of motion, and encourage them to create novel and individually powerful representations to help structure their thinking. In the third presentation, we explore the ways in which tables can provide first to third grade children with opportunities to solve problems that might otherwise be outside their reach. Results show that when children are able to use written supports such as tables, they can tackle more complex problems. We also found that even problems with initial unknowns (i.e., $x + 5 = 8$) and with unknown transformations (i.e., $5 + x = 8$) are not outside of children's reach when they have access to adequate representational supports. The fourth presentation deals with middle school students' understanding of tables when they are used as a bridge to construct a bar graph. Results show that the main difficulties in constructing the bar graph can be identified in students' table construction processes. Choosing an appropriate format that integrates several variables and correctly aggregates the data into frequencies are the main problems encountered by students, and these problems are related to the tables that they constructed to organize the data.

Early use of numerical notations
Nora Scheuer (Centro Regional Universitario Bariloche)
Montserrat de la Cruz (Centro Regional Universitario Bariloche)
Eduardo Martí (Universitat de Barcelona)

The weird dot: How children make use of conventional external representational tools to extend their thinking about motion and build new invented representations
Jason Kahn (Children's Hospital Boston)

Mathematical representations as tools among early elementary school children
Bárbara M Brizuela (Tufts University)
Mónica Alvarado (Universidad Autónoma de Querétaro)

Middle school students' understanding of tables as tools for constructing bar graphs
Merce Garcia-Mila (Universitat de Barcelona)
Eduardo Martí (Universitat de Barcelona)
Sandra Gilabert (Universitat de Barcelona)

9:00-10:30 DS02 Discussion Session 2 ..... Angel

Disequilibrating our views on doubt: A discussion

Organizer: Brian D Cox (Hofstra University)

Piagetian theory is generally considered to contend that development of cognitive structures is driven by cognitive contradictions between a child's current understanding and the demands of solving problems in the physical world. In mathematical and logical thought, the endpoint of this dialectic is the clear and distinct intuition of necessary truth. But before arriving at this point of certainty, a child or an adult must experience doubt (taken broadly to include uncertainty, vacillation, and indecision). It is a process of intuition, creative or random testing and play, followed by a conclusion of certainty. In spite of their importance as indicators of disequilibration in progress, forms of doubt have rarely been studied as phenomena in themselves.

The process of arriving at logical necessity is often described as an asocial, purely cognitive activity. The famous Piagetian activity of inventing-to-understand may begin in the individual, as when a child intuits a new way of solving math problems. Joe Becker will argue that doubt can only occur after a cognitive structure has begun and disequilibration is a result, rather than a cause of structural change. But the feeling of necessity may rarely happen without the intuition having been ratified by a discourse community in which the construct plays a significant role. Brian Cox will examine sociocultural processes that may contribute to the ratification of necessary truth. Finally, Cynthia Lightfoot will consider the deep interpenetrating cultural narratives surrounding the process of doubt and meaning construction embedded in the very notions of doubt, invention, discovery scientific and artistic creativity.

To foster a lively and relevant conversation, we will each address an example from math and/or science from our three perspectives. For instance, a simple word problem is of course, not simple at all: logical necessity in number conservation is often assumed to develop in the child, independent of specific cultural systems of representation. But symbol systems like place value, world knowledge such as representing time or practical constraints, and deep assumptions about how math works must be juggled with ease to solve such problems well. All participants will discuss how to make such processes more visible to aid understanding.

Participants:
Joe Becker (University of Illinois at Chicago)
Brian D Cox (Hofstra University)
Cynthia Lightfoot (Penn State University, Brandywine)

9:00-10:30 PS09 Paper Session 9..... Amador

Epistemology & Science Learning

Chair: Jeanne Bamberger (University of California, Berkeley)

Cultural values and the epistemological understandings and argument norms of Bedouins and Jews in Israel

Michael Weinstock (Ben-Gurion University of the Negev)

Researchers of personal epistemology have posited that people view knowledge as objective ("absolutist"), subjective ("multiplist"), or an integration of subjective and objective aspects ("evaluativist"), with a presumed development in that order. Adolescents appear predominantly multiplist. Studies have found relationships between epistemological understandings and argument construction and evaluation skills. However, most of the research has been conducted with Western samples. Studies in other cultures have suggested there might be cultural variation in the course of epistemological development and the types of epistemologies. The study looked at group differences and the role of cultural values. 305 Bedouin and 375 Jewish 9th and 11th graders in Israel were assessed for cultural values, epistemological level, and acceptance of argumentation norms. The groups differed by cultural values; Bedouins were more conservative and Jews were more mastery and autonomy oriented. Fewer Bedouins had multiplist epistemologies, and grade-related differences appeared only among Jews. The groups held some different norms of what is acceptable in arguing to justify knowledge claims. Beyond cultural group, cultural values predicted epistemology, and both cultural values and epistemology predicted argument norms. Cultural values and epistemology appeared to play roles in how people view the nature of knowledge and evaluate knowledge claims.

Mapping the conceptual ecology of complex emergent processes

Lauren Barth-Cohen (University of California – Berkeley)

Complex emergent processes are difficult to understand, and students tend to have alternative conceptions about how they work. Studies investigating these difficulties have not been able to differentiate between students' alternative conceptions with emergent processes and their lack of domain-specific knowledge (e.g. traffic jams, blood circulation, etc.) A novel feature of this analysis is that I take into account the diverse prior knowledge students' activate in thinking about the phenomenon, thus addressing a deficiency in the previous literature on this topic. In this paper I investigate students' reasoning about one complex emergent process: the movement of sand dunes. To understand students' changing knowledge in the context of complex emergent processes, I am informed by a model of knowledge presented in the Knowledge-in-Pieces epistemological framework. This model focuses on identifying the diverse knowledge elements within moment-to-moment learning contexts. Identifying the most prevalent knowledge elements students' use when reasoning about complex emergent processes can illuminate students' potential alternative conceptions. I discuss both the theoretical assumptions behind this model of knowledge, and the specific application of this model to my analysis processes. This paper sheds light on both students' knowledge systems about these complex emergent processes and how to model students knowledge.

Understanding children's epistemological development in vivo

Jessica Umphress (Northwestern University)

The processes by which children learn and make sense of their world are the focus of scrutiny across several research disciplines. Recent work in cultural psychology and educational research has begun pointing out that children often possess a multiplicity of worldviews, based on their personal experiences, and that these worldviews influence how they interact with new information, and formulate new ideas or restructure existing ones (e.g. Snively & Corsiglia 2001; Waxman & Medin, 2007). Inherent in understanding the formation and functioning of a worldview is the question: How do children develop epistemologically? That is, how do children develop or acquire the everyday, routine practices and procedures, rules, feelings, and biases that govern their sense of knowing and understanding their world? This paper presents work from two studies of children in vivo (e.g. within their families, homes, and everyday lives). These studies capture moments of children's investigation, construction, curiosity, and discourse around the natural, biological world, as well the way that those things do or do not fit within the practices of their everyday family life. This work supports in vitro work on children's epistemologies done in laboratories and classrooms, while expanding our understanding of the role of sociocultural environments on children's epistemological development.

Knowledge development about gravitation on Earth and in space

Sören Frappart (Université de Toulouse)
Valérie Frède (Université de Toulouse)
Michèle Guidetti (Université de Toulouse)

Counterintuitive knowledge about gravitation is difficult to acquire and few studies exist on its development. After a study on how the predictions of a dropped stone on Earth and beyond evolve with age (Frappart, Frède & Guidetti, 2010), we aim at understanding how schoolchildren justify those predictions. We have thus conducted 144 individual interviews of schoolchildren from kindergarten to high school where we asked them to justify their predictions about gravitation in different contexts. Results showed that on Earth and on an imaginary planet with air, expected predictions appeared whatever the age, but expected justifications appear at 12-13 years for the Earth and at 17-18 years old for the planet. On Moon and on a planet without air, expected predictions followed a "U" shape curve, while expected justifications appear only at 17-18 years old for both contexts. In a spaceship orbiting the Earth any expected justifications emerge while expected predictions appeared since 9-10 years old. We conclude that the effects of cultural mediation help schoolchildren to build some knowledge about gravitation but don't allow them to elaborate an expected complete understanding of gravitation. For that, we can hypothesis that dedicated teaching is required.

Scientific and religious invisible entities in children's mind

Silvia Guerrero (Universidad de Castilla-La Mancha)
Ileana Enesco (Universidad Complutense de Madrid)
Paul L Harris (Harvard University)

When and how children begin to differentiate between different bodies of belief, notable between science and religion? To what extent do children make use of testimony provided by other people in developing their ideas about the natural and supernatural world? (Harris, 2002). Few studies have compared children's reasoning and beliefs about entities from the scientific and the religious epistemological domains. In the present study, we interviewed 136 Spanish Catholic children aged 4 to 12 years about two invisible entities: a religious entity (God), and a scientific entity (oxygen). Children were asked about their beliefs in the existence and the nature (material-immaterial; visible-invisible) of each entity;

the degree in which they thought there is a social consensus about their existence; and the source of their knowledge regarding each entity. The results revealed age and conceptual domain differences in children's ideas regarding the real existence and nature of God/oxygen; the degree of social consensus, and the source of their knowledge (testimony, experience). Overall, children acknowledged the immaterial/invisible nature of oxygen (but not God); they judged that more people believe in oxygen than in God, and they attribute to different sources their knowledge about God/oxygen (testimony and experience, respectively).

9:00-10:30 PS10 Paper Session 10..... El Dorado

Observing the Development of Mathematical Knowledge

Chair: Ann Wakeley (University of California, Berkeley)

Tacit knowledge and mathematical education

Claudio Saiani (Universidade Federal Fluminense)

Following Michael Polanyi, we call tacit knowledge all perceptions, skills, theories, beliefs, prejudices, even values of a community, in which we rely in a subsidiary way when we are focused in a certain performance. For this approach, every knowledge is personal, as tacit knowledge depends on the knower's personal history. Therefore, it's so hard to be communicated. Mathematics is seen here as an intellectual passion, whose patterns of rigor and elegance, as well the skill to solve problems, are transmitted to beginners by working with more experienced mathematicians. As no set of rules is sufficient to solve problems, unless they can be integrated into a practical knowledge transmitted by tradition, the solution of a problem implies an always personal balance between intuition and computation, which includes tacit knowledge. So, four moments of knowledge transformation are suggested, in order to improve tacit knowledge sharing: from tacit to tacit, from tacit to explicit, from explicit to explicit, and from explicit to tacit. They can occur in any moment of a lecture, or in cooperative learning. The tacit component of problem solving stresses the importance of examples and outlines of solutions, cooperative learning, and teacher's examples and attitudes.

Representational forms in activity: Grade 5 students understanding of graphs of algebraic functions

Darrell Earnest (University of California – Berkeley)

This study seeks to understand ways that elementary aged students can come to understand representations used to support algebraic reasoning. In Study 1, I assess Grade 5 (n=80) students' performances (written assessments and student interviews). The instrument includes tasks involving representations identified as core to elementary school algebra (Carraher & Schliemann, 2007), including number lines, the Cartesian plane, and graphs of algebraic functions. Study 2 involves a tutorial in the form of a communication game with Grade 5 students. The tutorial builds on recent work to support students' understanding of the integer number line (Saxe et al., in press), extending the tutorial approach to the Cartesian plane and graphs of algebraic functions. Study 1 assessment scores were used to match pairs with identical scores, with one partner assigned to the experimental tutorial condition (n=18) and the other assigned to the control group (n=18). Qualitative analyses adopt a form-function framework (Saxe, 2004; Saxe & Esmonde, 2005) to reveal shifts in the ways students ascribe meaning to representational forms throughout the tutorial. Findings point to shifts in form-function relations as mathematical principles become explicit in the context of the communication game tutorial.

Supporting development of mathematical reasoning through classroom practices

Jessie C Store (The University of North Carolina at Greensboro)
Sarah B Berenson (The University of North Carolina at Greensboro)
Nancy T Payne (The University of North Carolina at Greensboro)

In a teaching experiment with fifth grade students we observed the development of mathematical reasoning over a 3-day period. There was a decrease in number of students using recursive generalizations indicating a shift towards using explicit generalizations. Additionally, there was a shift in the justification types with decreases in authoritarian and empirical schemes. These results are generally at odds with past research that reported students' tendency to use recursive rules and empirical justifications. Using observation notes, teacher's reflections, transcripts of audio and video recordings for small group and whole class discussions as sources of data, we explored the classroom practices that supported such development of mathematical reasoning. The analysis revealed that the teacher's practice balanced the support of discourse and mathematical reasoning and may be one of the factors that promoted the development of generalization and justification fluency.

Manifestations of a mathematical learning disability across topic domains: A unique case

Katherine E Lewis (University of California – Berkeley)
Dylan Lynn (University of California – Berkeley)

Mathematical learning disabilities continue to be poorly understood due to a lack of sufficient subject identification methods and an exclusive focus on basic arithmetic. The purpose of this study is to explore a particularly unique case: an individual with a mathematical learning disability who, nevertheless, has decided to major in mathematics. Despite her pervasive difficulties with processing and manipulating quantities, she is passing upper-division math classes at a prestigious university. She therefore, has unique insight into the kinds of difficulties experienced across mathematical topic domains and the ways in which she has compensated. Through clinical interviews we explore the nature of her difficulties as well as the ways in which she compensates. The goal is to better understand how mathematical learning disabilities can manifest across mathematical topic domains and shed light on potential avenues to consider for remediation.

The role of definition in developing a mathematical system

Marta Kobiela (Vanderbilt University)

Definition is a fundamental form of activity that grounds professional practices of conjecture, theorem and proof. Yet in school mathematics, definition is often treated as a matter of pre-specified axiom. We describe an alternative approach in which sixth-grade students invented and revised definitions during the course of investigations about space and geometry. Defining led to contest about taken-for-granted intuitions about the nature of space, such as "straight," and to the creation of new mathematical objects. A mathematical system emerged as relations among defined objects were constructed and extended, first by conjecture and later by theorem and proof. We trace how apparently simple forms of definition led to substantive mathematical investigation. We conclude by recounting an episode based on this classroom history during which members of the class developed a theorem by appealing to embodied (e.g., Abelson & diSessa, 1980) definitions of diagonals, vertices and sides as walked paths.

9:00-10:30 PS11 Paper Session 11.....Mariposa

Moral and Social Development I

Chair: Larry Nucci (University of California, Berkeley)

Young children's judgments about violating gender norms in public and private

Clare Conry-Murray (Penn State University, Beaver)

Children ages 4-5 years (n=27) and 7-9 years old (n= 26) made judgments about whether children should follow their interests when it was counter to gender norms. Children were asked which of two items the character should choose, the gender typical toy or the toy that was preferred, (1) in private, (2) in public, and (3) in a country where the reversed preference was typical for that culture. In private and in another culture, over 90% of children at both ages endorsed choosing the preferred item. In public, 67% said to choose the preferred item and there were no age effects. A gender of the character effect indicated that when the character is a girl, 74% judged that it was OK to use the item in public, while only 60% made this judgment when the character was a boy. The most common justification for this question was personal choice, and the second most common justification was a concern with teasing. The results indicate that children recognize that people should be able to make a choice based on preferences instead of gender norms, and when they do not, their dominant concerns is with teasing.

Is it fair(ness)?: Cultural variation in Mexican parents' and children's perceptions of fairness for children's participation in family household work

Andrew D Coppens (University of California, Santa Cruz)
Lucia Alcalá (University of California, Santa Cruz)
Barbara Rogoff (University of California, Santa Cruz)

Children in many communities are involved in the daily household work activities of their families; however, cultural variation may exist in how responsibility is shared and understood, and in the reasons given for children's participation. This study examined the responses of both mothers and 9- to 10-year-old children from a Mexican Indigenous-heritage and Cosmopolitan community to a series of questions about the "fairness" of asking a child to contribute to various household work tasks. Preliminary findings suggest that children and parents from an Indigenous-heritage community view family work as fair when children autonomously choose to help (and retain the option not to). These families described work responsibilities as flexibly shared among all members of the family. By contrast, parents and children in a nearby Cosmopolitan community often described "fair" work in terms of contracts in which children's and other family members' responsibilities were firmly connected to assigned tasks, to their own spaces and belongings, or to problems they themselves created.

Am I being just? Educative Conceptions of Brazilians Parents

Luciana Maria Caetano (University of São Paulo)
Maria Thereza Costa Coelho de Souza (University of São Paulo)

The question "am I being fair?" is always a good one for parents that wish to cooperate with his children favoring the construction of his/her moral autonomy. The purpose of this study is to put together a map of parents' educational conceptions about respect and justice as well to do qualitative analysis of the answers given by Brazilian Parents concerning their educative conceptions about respect and justice. The sample consisted of 860 parents of teenagers between the ages of twelve and twenty years old. There were participants representing all Brazilian territory' regions. The participants answered collectively the instrument in writing. The Educative Conceptions Scale (after statistical validation, CFA) finalized with 13 items, being 5 items for respect and 8 items for justice. The results of each item of the scale were

analyzed qualitatively in conformity to Piaget's Moral Development Theory as well as in regard to the research about parent adolescent relationship in the last ten years. Our goal is through the qualitative analysis of the answers given in each of these items to interpret their answers in order to understand the parental functions representations they offered and also compare these to their interventions.

Self-compassion and motivation

Kristin D Neff (University of Texas at Austin)

The number one reason people give for why they aren't more compassionate to themselves is fear of laziness and self-indulgence. Self-criticism is viewed as a more useful and effective motivator instead. While this type of thinking is common, is it true? The depressionogenic aspects of self-criticism, for instance, can undermine the energy and effort needed to make necessary changes. Self-criticism also makes it harder to see yourself clearly - who wants to own up to their shortcomings if honesty is going to be met with harsh self-judgment? I will argue that self-compassion is a more effective motivator than self-criticism because its driving force is care not fear. Unlike self-criticism, which asks if you're good enough, self-compassion asks what's good for you? If you care about yourself, you'll do what you need to in order to reach your highest potential. You'll want to change maladaptive patterns of behavior, even if that means giving up things you like, because you care about yourself and want to be happy. This paper will provide an overview of the research evidence indicating that self-compassion is in fact a healthier, more sustainable, and more effective way to motivate yourself than self-criticism.

Children's reasoning about deception at home and in school

Matthew Gingo (University of California – Berkeley)

This study examines the development of children's judgments about deception of authority figures with regard to the nature of the directive being given and the social position of the authority figure giving the directive. The study was conducted in two schools and included 20 students from each of the 2nd, 3rd, 4th, 5th, 6th, and 7th grades. In a clinical interview, participants evaluated hypothetical stories depicting children defying the directives of authorities and then deceiving the authorities about their noncompliance. The stories depicted prototypical acts in the moral, personal, and prudential domains. Children evaluated the legitimacy of each directive being given, the violation of that directive, and the deception about the noncompliance, justifying their response to each. Patterns of age-related, act-related, and authority related variance were found for judgments and justifications. The findings suggest that children as young as seven years old engage in complex coordinations of social and moral issues, and systematically endorse deception about certain types of acts in certain authority relationships, while rejecting it in others.

Being mean: Children's gendered perceptions of peer teasing within the classroom

Sandra Bosacki (Brock University)
Debra Harwood (Brock University)
Corina Sumaway (Brock University)

Recent research suggests that social cognition may play a role in the connections among gendered experiences of teasing within the grade school classroom. Within the framework of social-cognitive developmental theory, this paper addresses the main question of how children come to know, and learn to live with their gendered emotional selves and within the context of peer relationships with difficulties. That is, how do children learn to think of themselves as gendered and emotional beings within the context of social relationships and learn to have control over their mental and social worlds? Specifically, building on past theories of teasing and social cognitive behaviour and drawing on past and current research that explore children's perceptions of peer teasing, we aim to illustrate how we can move forward to

further the discourse about theory, methodology, and practice in gendered sociocognitive development and teasing experiences. We argue that children's understanding of themselves as gendered, emotional beings is part of a complex, developmental process that is dynamic and co-constructed within a safe and peaceful learning community of body, minds, and souls. We end the discussion with future research questions to guide developmental and educational research with precise, conceptually sound definitions, respectful and accurate research methods, and meaningful dissemination.

10:30-10:45 break

10:45-12:00 PL03 Plenary Session 3: ..... Ballroom

The social lives of children: What a micro-ethnographic focus on children's interests and concerns can tell us about early STEM learning

Reed Stevens (Northwestern University)

This talk will report on a field study of young children's learning across home and pre-school environments. Based on evolving analyses of about 500 hours of video recordings of children's everyday activities with parents, teachers, sibling and peers, this presentation argues for a video-based ethnographic approach as a new slant for developmental studies. The presentation relates our approach to the Piagetian developmental tradition, discusses the general affordances of each approach, and highlights the unique strengths of studying young children's learning in their familiar cultural contexts of everyday life. I will argue that the strengths of this approach allow us to understand the social functions and social occasioning of learning-related phenomena such as imitation, attention, and concept formation. By focusing on children's interests and concerns as our core phenomena within a broadly ethnographic stance, we will argue that learning generally and STEM learning specifically can be understood in new ways and cultivated in early life.

Friday—P.M.

12:00-1:15 Lunch

12:00-12:30 MEM Annual Members Meeting.....Khorassan

Annual Members Meeting — all are welcome to attend

Agenda

1. Opening Remarks — Geoffrey Saxe, President

2. Minutes of the 2010 Annual Members Meeting—Saba Ayman-Nolley, VP Communications

3. Financial Report

Ashley Maynard, Treasurer
Stephanie Carlson, VP Program Arrangements and Funding Support

4. President's Annual Report—Geoffrey Saxe, President

Special Announcements:
Recipients of the Peter Pufall and Jacobs Foundation Travel Awards
Donated film series now available (Keith Alward)
New Members of the Board of Directors 2011-2014:
Ayelet Lahat, Susan Rivera, Vera Maria Ramos de Vasconcellos, Nancy Budwig, Elliot Turiel

5. Local Arrangements Report—Linda Platas, Coordinator of Local Arrangements

6. JPS 2012—Larry Nucci, VP Meeting Planning

7. New Business

1:15-2:45 IS03 Invited Session 3.....Belvedere

What happens when children design their own toys? Exploring developmental outcomes of engineering education in the elementary grades

Organizer: Gary Benenson (City College, New York)

Design includes processes that are endemic to human life, but most design is performed reflexively rather than systematically. Engineering design incorporates a systematic approach, which includes evaluation of a possible design in light of the design goals, and therefore leads frequently to redesign. Design is a social process, because no one designer typically has all the information needed, nor all the relevant skills. When students design devices that are important to them, the motivation to learn can be powerful.

Engineering design could play a significant role in promoting cognitive, affective and social development. Unfortunately, engineering is not generally a school subject in the US, unlike in most other industrialized countries. Consequently, there have been few opportunities to explore the potential of engineering education, let alone conduct systematic research. The City Technology Project at City College has developed a set of materials, "Physical Science Comes Alive!" that use engineering design projects to promote math and science concepts, problem-solving, language and social development. Students design, make and test mechanical linkages including three-dimensional mechanical pop-ups; vehicles powered by gravity, elastic media or electricity; and mystery books and cards with hidden switches.

In this session, three New York City public elementary teachers will each present studies of several of their own students, as they engage in "Physical Science Comes Alive!" curriculum units. All three teach-

ers are part of the team that has developed these materials, and each teacher has selected an area of study that is important to him or her. One is a pre-K/K science specialist, who teaches in a school that has a large English Language Learner (ELL) population. He is studying how pre-K and kindergarten students develop concepts of redesign, language and facility with materials, as they attempt to build pegboard linkages and gravity-powered cars. The other two presenters teach fourth- and fifth-graders, respectively. One has a mixed class, including both General and Special Education students, and both have significant numbers of ELL's. These two presenters will focus on how the design of pop-ups, hidden circuits and electric-powered vehicles are fostering language development, motivation for school work and social interaction. The Project Director of "Physical Science Comes Alive!" will provide an overview of the work, and some context about where it might lead. The session will provide glimpses of what engineering design can look like in an elementary classroom, and suggest directions for systematic research.

Travis Sloane (PS 971, Brooklyn, NY)
Janice Porter (PS 5, Brooklyn, NY)
Cherubim Cannon (PS 5, Brooklyn, NY)

1:15-2:45 SY15 Symposium Session 15.....Yerba Buena

Children's conceptions of science: Implications for education

Organizer: Robert Louisell (St. Cloud State University)
Organizer: Abel Ruben Ulloa-Hernandez (Universidad de Guanajuato)
Discussant: Robert E Stake (University of Illinois, Urbana-Champaign)

This symposium discusses four papers about children's conceptions of science and their implications for education. The first paper, Children's Ideas About the Moon: Interviews From Australia, the U.S., and Mexico, summarizes interviews conducted in Australia, the U.S., and Mexico concerning children's ideas about the moon. The interview protocol was adapted from Piaget's Child's Conception of the World, but it required interviews with parents as well as with children. The second paper, Learning From Successive Social Situations: How Social Heterogeneity Supports the Scientific Abilities of 10 Year Old Children About Buoyancy, compares children's understandings of buoyancy before and after various combinations of collaborative and individual learning situations; for example, after only individual or collaborative learning experiences as opposed to after alternating between individual and collaborative experiences. The third paper, Marbles move: Taking a Task From Piaget's Experiments Into the High-School Classroom, adapts experiments with movement and causality that were originally developed by Inhelder and Piaget but carries them out during a high school laboratory lesson on Newtonian mechanics. Students are engaged in either physical or virtual activities but the type of experience—physical or virtual—affects what they actually learn from the experience. The fourth paper, The Impact of a Space Museum Visit On the Development of Knowledge of Gravitation, studies how 13 and 14 year old students respond to questions about gravity's influence on a stone that is dropped on the earth or in space. However, some students were only asked these questions after being instructed in school while others had the opportunity to follow their school experience with a visit to a space museum. Students who visited the museum gave significantly markedly better predictions about the fall of a stone on earth as well as in outer space. Robert Stake, coauthor of Case Studies In Science Education (Stake and Easley, 1978) critiques each study and leads a discussion on the implications for education.

Children's ideas about the moon: Interviews from Australia, the U.S., and Mexico

Robert Louisell (St. Cloud State University)
Abel Ruben Ulloa-Hernandez (Universidad de Guanajuato)

Learning from successive social situations: How social heterogeneity supports the scientific abilities of 10 year old children about buoyancy

Romain Boissonnade (Université de Neuchâtel)
Valérie Tartas (Université de Toulouse II)

Marbles move: Taking a task from Piaget's experiments into the high-school classroom

Alaric Kohler (University of Neuchâtel)

The impact of a space museum visit on the development of knowledge of gravitation

Sören Frappart (Université de Toulouse)
Valérie Frède (Université de Toulouse)

1:15-2:45 PS12 Paper Session 12.....Treasure

Cognitive Development, Math, and Science

Chair: Maryl Gearhart (University of California, Berkeley)

Relying on footprint trails for determining direction of travel during years 3-to-6

Eugene Abravanel (The George Washington University)

In an earlier naturalistic investigation we found that preschool children under 5-years were mainly unsuccessful at symbolically utilizing a footprint trail to signify the room in which a person was hidden. In the present study, a second attempt was made to investigate understanding and competence at footprint tracking when the space was markedly reduced in scale using a pictorial format. Results indicated that at all ages the overall trend was for greater success when children confronted a small-scale version of the task than when operating in a large-scale naturalistic spatial environment. The information processing demands attributable to scale were considered to be most important for understanding the disparate outcomes associated with the two investigations. Even with a reduction in processing demands, however, an age effect was present with 4-,5-, & 6-year-olds succeeding at utilizing trails more frequently than 3-year-old children. With respect to symbolically-guided spatial performance , the advantages of a small-scale space might outway those of a much more extended naturalistic one.

A movement game for learning about decision theory

Gregory Dam (Northwestern University)

We present a movement game designed to explore the probabilistic nature of decision processes. During the learning activity, students perform a movement version of Kahneman and Tversky's (1979) decision experiment. People often demonstrate systematic deviations from optimal probability judgments. Biases in judgments of probability have been regarded as one of the sources of difficulty when learning about probability. Movement decisions involve an assessment of the likelihood of possible outcomes. In contrast to decisions made in other domains, research shows that people accurately assess the probability of movement outcomes and demonstrate near optimal use of these judgments during movement decisions. In the activity presented, students make movement decisions by controlling the position of a cursor on a computer screen using motion sensor technology. The objective is to attempt to hit selected targets while the cursor's position is varied according to a probability distribution. Added noise to the cursor position increases the decision uncertainty in a manner that can be changed parametrically. Students draw from their haptic experience of outcome variability and their understanding of the probability distributions that govern cursor position to analyze how knowledge of probability can inform decision making. The activity is implemented in NetLogo using Nintendo Wii™ technology.

Form, function, and habitat: Similarity of responses among college students and primary school children to questions about evolutionary relatedness

Brenda Phillips (Harvard University)
Laura Novick (Vanderbilt University)
Kefyn Catley (Western Carolina University)

The current two studies address the question of whether children and adults reason in qualitatively similar ways about evolutionary relatedness as depicted in the tree of life. In particular, these studies assess the cognitive and diagrammatic factors that may impede the ability to acquire scientifically valid explanations regarding evolutionary relatedness. Study 1 examines whether children (age: 5-7 years) and adults (age: 18-23) privilege their prior, non-scientific beliefs when evaluating relatedness among specific biological groups (e.g., dolphins and sharks are "sea animals"). Both groups of participants in Study 1 were less accurate on trials that conflicted with their folkbiological beliefs and more accurate on trials that supported their folkbiological beliefs. Importantly, the accuracy scores for children and adults did not differ significantly. Study 2 then examines whether, in the absence of conflicting evidence, children and adults rely on diagrammatic features to reason correctly about the relationships among taxa. These data provide critical information regarding the developmental trajectory of evolutionary diagrammatic reasoning skills in early and middle childhood. Our paper will focus on how these data will contribute to the development of empirically based science curricula for children in primary and secondary schools.

Young children's Euclidean thinking during block and brick play

Daniel Ness (Dowling College)
Stephen Farenga (Dowling College)

Studies on young children's mathematical thinking during free play reveal intrinsic connections between informal spatial and geometric knowledge and the use of blocks and bricks for construction. However, the nature and characteristics of children's spatial and geometric thinking processes are not so clear. In their classic study on the concept of space, Piaget and Inhelder (1967) conclude that children's spatial development emerges from topological primacy in early childhood, transitions through projective space, and finally reaches Euclidian forms that they regard as commonly associated with the spatial thinking of older children and adolescents. In this paper, we demonstrate that, contrary to Piaget and Inhelder's thesis, young children possess overt Euclidean conceptions of space, particularly when engaged in brick (e.g., Lego™) and block activities during free play. The following questions were investigated: What types of patterns do children explore? What types of shapes do they construct? What kinds of architectural principles underlie their frequent play with bricks and blocks?

Links between motor behavior and cognitive development: The case of exercise

Patricia H Miller (San Francisco State University)
Phillip D Tomporowski (University of Georgia)
Jennifer E McDowell (University of Georgia)
John R Best (University of Georgia)
Catherine L Davis (Medical College of Georgia)

Piagetian, and other, research suggests that motor behavior contributes to infant and toddler cognition. However, little is known about a) such connections in older children, or b) the role of speeded movements (i.e., exercise) in cognitive development. We assessed executive function (CAS, Cognitive Assessment System) and academic achievement (Woodcock-Johnson Tests of Achievement III) in overweight children (N=163) ages 7-11in a pretest-posttest design, with a 3-month exercise program in between. Exercise consisted of vigorous, fun games such as tag, jump rope, and ball games 5 days a week in our research gym. Aerobic exercising improved EF compared to the control group (no exercise

program) in a linear fashion (a priori linear contrast, p = .013, 40 minutes per day> 20 minutes per day> control). As predicted, the effect was specific to EF (i.e., was not found on other high level cognitive skills). The same results emerged for math achievement (p = .045). Changes in fMRI activity in the exercise group implicated EF. Possible mediators are BDNF (brain-derived neural growth factors), leading to angiogenesis and neurogenesis, or practice with planning and predicting movements, rapid decision-making about bodies in motion, effortful involvement, etc., during exercise.

1:15-2:45 SY16 Symposium Session 16..... Angel

Picturing objects in infancy and toddlerhood: Perceptual and conceptual developments in pictorial competence

Organizer: Jeanne L Shinskey (Royal Holloway, University of London)
Organizer: Sarah M Shuwairi (Lehman College CUNY)

Pictorial competence describes a range of skills used to interpret information presented in images. This range extends from infants' ability to perceive depth in a picture, to children's ability to understand maps, to adults' ability to appreciate abstract art. How do these abilities develop to allow children to become competent symbol users? This symposium brings together researchers from four different labs to present new results on the development of pictorial competence in the first 2½ years of life. The first talk shows that infants' sensitivity to images of possible and impossible objects extends beyond visual discrimination: Nine-month-olds engaged in more manual exploration, social referencing, and vocalizing with realistic photos of structurally impossible objects relative to possible objects. The second talk addresses infants' ability to represent an object depicted in a photo. Nine-month-olds searched more for a hidden object if they had first been familiarized with a photo of it, whereas younger and older infants searched equally for depicted and non-depicted hidden objects. The third talk demonstrates that toddlers' association of an object with a picture or a word is representational rather than perceptual. Fifteen-month-olds extended a novel word from a picture of an object to the real object even when the object differed in color. The final talk addresses the role of perceptual equivalence in symbolic retrieval tasks. The more perceptual similarity between initial trials and test trials, the more often children made perseverative errors, at age 2 with a picture task and 2½ with a scale model task.

Infants' response to pictures of impossible objects
Sarah M Shuwairi (Lehman College CUNY)
Annie Tran (Lehman College CUNY)
Judy S DeLoache (University of Virginia)
Scott P Johnson (UCLA)

Can pictures strengthen infants' object representations?
Jeanne L Shinskey (Royal Holloway, University of London)
Liza Jachens (Royal Holloway, University of London)
Kate Ryan (Royal Holloway, University of London)

Infants map words and pictures to abstract kind representations, not just to featural similarity
Kathleen Geraghty (Northwestern University)
Sandra Waxman (Northwestern University)
Susan A Gelman (University of Michigan)

The impact of perceptual similarity on children's symbolic search behaviour
Gelareh Jowkar-Baniani University of Toronto)
Mark A Schmuckler (University of Toronto)

1:15-2:45 SY17 Symposium Session 17 ..... Amador

Biases and awareness in numerical judgments: Dual processes in development

Organizer: Sarah Furlan (University of Padova)

Decades of research emphasizes that people are often poor decision-makers. Regardless of their cognitive abilities, their decisions, particularly numerical judgments, are likely to be biased because of the use of intuitive heuristics. As Milkman, Chugh and Bazerman (2009) pointed out, we have little understanding of how to help people overcome their many biases and make optimally probabilistic judgments. Dual-process theories, which postulate the existence of two distinct reasoning processes that operate in parallel, have been used to explain adults' suboptimal decision-making performance and to identify conditions which promote optimal performance. Dual-process theories have important implications for understanding cognitive development and developmental studies have provided a unique perspective on the nature, development, and coordination of the multi-component processes composing these models of decision making (Klaczynski, Byrnes, & Jacobs, 2001). In this symposium, new findings are presented regarding factors affecting the development of optimal reasoning about probabilities from a dual-process perspective. Paper 1 reveals that optimal reasoning about ratios can be promoted by consciously and unconsciously eliciting analytic processing in participants, although such effects are shown to be influenced by metacognitive abilities. Paper 2 examines how context influences insight for the optimal response regardless of the probability ratio, and how it generates different age-related biases. Paper 3 demonstrates how 12-year olds, but not 8-year olds, can detect that their intuitive judgments are questionable (conflict with probabilistic norms) as well as adults do. Finally, Paper 4 shows how training benefits both children and adults, but instructions to reason logically benefits higher-capacity students more. In lieu of a discussant, the participants will focus on the data from the symposium regarding the interactions among training, instructions, and context in the development of probabilistic reasoning; differences between recognition and expression of competence; and effects of awareness of biases. This discussion will highlight commonalities and differences in dual process accounts of the development of decision making.

Optimal reasoning about ratios: The development of dual process regulation

Eric Amsel (Weber State University)
Amy Trevethan (Weber State University)

When context overrides numerical evidence: Ratio bias in the development of probability judgments

Sarah Furlan (University of Padova)
Franca Agnoli (University of Padova)
Valerie F Reyna (Cornell University)

Base-rate neglect and the development of bias awareness

Wim De Neys (Université de Toulouse)

Making use of relevant knowledge in probabilistic reasoning: The role of cognitive capacity and mental effort

Kinga Morsanyi (University of Plymouth)
Francesca Chiesi (University of Florence)
Caterina Primi (University of Florence)
Simon Handley (University of Plymouth)

1:15-2:45 PS13 Paper Session 13..... El Dorado

Discourse in Science Education

Chair: Michael Ford (University of Pittsburgh)

Transforming argumentation norms into epistemic understanding of science: How younger students appropriate argumentation norms?

Suna Ryu (University of California, Los Angeles)
William A Sandoval (University of California, Los Angeles)

This study explores how a classroom community negotiates and appropriates scientific argument norms. We addressed a specific question, how do argumentation norms emerge and become negotiated and appropriated? In this study, we approached argumentation as a social practice governed by discursive, negotiated norms and according to what makes a good argument, rather than a cognitive skill. The study occurred in a combined third-and fourth-grade classroom consisting of nine third graders (five boys and four girls) and twelve fourth graders (six boys and six girls) with an experienced teacher. To trace how norms were negotiated and appropriated, we videotaped and analyzed every science class (56 total) for the entire school year (2009-2010). Interaction analysis (Erickson, 1992) and case comparison analysis (Fairclough, 2001) were used to trace changes regarding norms in discourse use and the performance of students. We also conducted group interviews, examining what norms students thought were important and what norms were enacted. We used longitudinal and ethnographic interview methods (Schensul et al., 1999) and an analysis of chronological interview data (Cobb & Whitenack, 1996; Hall, 2000). Students actively generated, negotiated, and refined the meanings of norms; this refinement process encouraged students to develop more high-level, sophisticated norms.

Understanding classroom affordance of scientific argumentation practices: Through the perspective of classroom interactive history

Xiaowei Tang (Southwest University)
Janet Coffey (University of Maryland)

A common approach to the study of scientific argumentation in classrooms is to consider structural accounts of students' scientific argumentation. From the same paradigm come curricular units and instructional strategies designed to support development of structural dimensions of argumentation. In this paper, we argue that practices of classroom scientific argumentation cannot be fully understood in isolation; rather, students' scientific argumentation needs to be examined as rooted in ongoing classroom interactions, often extending beyond norms and discourses of argumentation. From a sociocultural-historical perspective, we traced the interactive history of a high school biology class. Close discourse analysis illustrates how affordances and constraints for scientific argumentation practices were built over time. Analysis revealed that classroom interactions beyond argumentation can contribute significantly to the construction of classroom learning goals, interactional norms, teacher-student relationships and epistemic resources, which in turn, frame and inform the scientific argumentation practices we see in classroom.

Context counts: Role of the context in triggering productive and unproductive knowledge pieces about natural selection

Aditi Wagh (Northwestern University)
Uri Wilensky (Northwestern University)

Evolutionary theory is counterintuitive. A lack of understanding and acceptance of evolution is widely prevalent. A considerable body of work points to the existence of robust misconceptions and cognitive biases about evolutionary mechanisms such as natural selection. In light of this work, this study adopted

a knowledge-in-pieces perspective to identify cognitive resources children have that can be built on in learning about natural selection. Eighteen eighth graders' responses to agent and aggregate-level questions were analyzed to identify the kinds of knowledge pieces elicited by the questions. The findings indicate that agent-level questions triggered knowledge pieces that played a productive role in reasoning about natural selection. In contrast, aggregate-level questions triggered unproductive knowledge pieces in making sense of natural selection. These findings have implications for the design of learning environments, which have been discussed in the paper.

Distributed agency in framing generative inquiry in an elementary science classroom

Lama Jaber (University of Maryland-College Park)
Luke Conlin (University of Maryland-College Park)
David Hammer (Tufts University)

An objective for elementary science education is that students come to understand and appreciate inquiry in science in ways that reflect disciplinary practices (Engle & Conant, 2002; Ford, 2008). They should form a sense of inquiry as about coming up with ideas about the natural world, evaluating, and refining these ideas for "intelligibility, plausibility and fruitfulness" (Smith, Maclin, Houghton, & Hennessey, 2000). We understand their sense of what they are doing as their framing (Goffman, 1974; Hammer, Elby, Scherr, & Redish, 2005; Tannen, 1993), and we strive to understand how students come to frame their activities in productive ways. In this paper, we analyze the dynamics of an interaction in a fifth-grade science class discussing evaporation, as an instance of productive framing. During this 4-minute episode, we see Daniel presenting an idea, Cassandra challenging it while making moves to ease social and affective tensions, and the teacher reinforcing each of these contributions. We argue that this distributed agency amongst students and teacher in framing the conceptual, epistemic, social and affective aspects of the dynamics, allows the class to establish and maintain a culture of generative inquiry, hence should be considered a central goal in elementary science classes.

"Why Does It Choose to Go That Way?" Identifying Pivotal Discourse Events in Model-Based Inquiry

Alfred R Schademan (California State University, Chico)
Leslie Atkins (California State University, Chico)
Julie Monet (California State University, Chico)
Irene Salter (California State University, Chico)
Michael Kotar (California State University, Chico)

This study highlights discourse events that play a pivotal role in model-based inquiry (MBI) with preservice teachers in an elementary science methods course. Employing microethnographic methods to examine science classroom discourse, we identify and analyze pivotal "inquiry events" that occur as students create models in an attempt to explain observed phenomena. A central finding is that MBI, as well as student comments and questions, can move classroom discourse from rule-based to mechanistic explanations. Mechanistic explanations attempt to explore the reasons why natural phenomena occur; whereas, rule based explanations provide only surface level understandings. Further, mechanistic explanations often employ central practices of modeling (i.e., analogous reasoning) and therefore support the development of scientific forms of reasoning. The study concludes that in order to encourage science teachers to move past traditional science pedagogies, it is imperative that we identify the pivotal events that teachers and students can capitalize upon as gateways into student modeling that support robust forms of scientific reasoning.

1:15-2:45 PS14 Paper Session 14.....Mariposa

Designing for STEM teaching and learning

Chair: Maria Varelas (University of Illinois at Chicago)

Dialectical investigations of mathematical discovery: The emergence of disciplinary forms in an embodied-interaction design for proportions

Dor Abrahamson (UC Berkeley)
Dragan Trninic (UC Berkeley)
Jose F Gutiérrez (UC Berkeley)

Responding to recent calls to develop cognitivist-cum-sociocultural theoretical models of mathematical learning, we present case analyses of students' creative appropriation of forms emerging from interaction with symbolic artifacts. In this bootstrapping procedure, problem solvers: (1) hook – when a symbolic artifact is first introduced into the interaction space, they engage it because they recognize its contextual utility for enhancing the enactment, explanation, or evaluation of their current solution strategy; then (2) shift – in the course of implementing these new affordances, they notice in these artifacts additional embedded properties as affording a new or reconfigured strategy that better meets domain-general criteria of conciseness, precision, prediction, and – in the case of co-production with a peer – communication, coordination, and collaboration. These new strategies are then sanctioned by the instructor, who views the shift as advancing the child's process of mathematization closer to disciplinary structures and procedures, in accord with the intervention's pedagogical objectives. We support and elaborate the proposed constructs with a set of selected episodes from videographed empirical data gathered in a design-based research study that investigated the emergence of mathematical concepts from guided embodied-interaction activity (n=22; ages 9-11). We list and explain critical interaction dimensions enabling such learning.

Relations of instructional tasks to student learning outcomes in China's reformed elementary mathematics classrooms

Yujing Ni (The Chinese University of Hong Kong)
Dehui Zhou (The Chinese University of Hong Kong)
Xiaoqing Li (The Chinese University of Hong Kong)
Qiong Li (Beijing Normal University)

One of the goals for the 2000's mathematical curriculum reform in the mainland China is to develop in students the competence to solve mathematics problems and the positive attitude towards learning mathematics by employing instructional tasks that set high cognitive demands, use multiple representations, and require multiple solution strategies. A recent study of the curricular influence on teaching and learning mathematics in China showed that teachers in the reformed mathematical classes were more likely to use the instructional tasks with high cognitive demand, multiple representational means, and multi-solution strategies than were the non-reformed mathematical classrooms. How do these new features of instructional tasks relate to students' mathematics learning outcomes? The present study, involving six-grade students from 32 reformed mathematical classrooms, examined effects of the features of learning tasks on student learning outcomes. The results indicated that the high-level cognitive demand tasks did not show a direct positive influence on students' cognitive learning outcomes. Instead, the high-level cognitive demand tasks exerted positive effect on students' affective learning outcomes including their expressed interests in learning mathematics, classroom participation, view of mathematics, view of learning mathematics, which in turn positively affected their cognitive learning outcomes including computation and open-ended problem solving.

Supporting elementary students' knowledge construction of measures of center: A PAD-based approach

Victor R Lee (Utah State University)

Physical activity data (PAD) technologies, such as pedometers and heart rate monitors, are data collection tools used primarily within a culture of physical fitness. The goal of this project has been to repurpose those technologies as potential resources to support student learning in mathematics and science. Specifically, this presentation describes an effort to design and evaluate two weeks of fifth grade classroom instruction in which students needed to learn about measures of center such as the mean, median, and mode. In the designed unit and with support from a facilitator, students actively constructed representations of data and methods for computing the three measures of center. In comparison to a separate control classroom of fifth grade students at the same school, the students in the designed unit performed just as well on a written assessment. In clinical interviews about how and when to compute measures of center, students who participated in the designed unit showed significantly greater improvements in their understanding. The results of this work suggest that a PAD-based approach for supporting students' knowledge construction is feasible and potentially beneficial.

Mathematization and embodiment for reasoning about mechanism within an engineering curriculum

Marta Kobiela (Vanderbilt University)
Molly Bolger (Vanderbilt University)
Paul J Weinberg (Vanderbilt University)
Rob Rouse (Vanderbilt University)

Although simple mechanisms are commonplace, reasoning about how they work—mechanistic reasoning—is often challenging. To foster mechanistic reasoning, we engaged third- and sixth-graders in the design of kinetic toys that consisted of systems of linked levers. To make the workings of these systems more visible, students participated in forms of activity that we conjectured would afford bodily experience of properties of these mechanisms which students had difficulty with in a previous study: constraint and rotary motion. Students progressively re-described and inscribed these embodied experiences as mathematical systems. We report a microgenetic comparative case study of two students, along with microgenetic coding of additional students, tracing how embodiment and mathematization supported the development of their mechanistic reasoning about how these levered systems operate. Our results highlight ways in which embodiment and mathematization have potential to support students as they construct explanations for simple machines. These cases have potential implications for the design of classroom learning environments.

Threading mathematics through symbols, pixels, sketches and wood: Tailoring high school STEM instruction to build cohesion across modal engagements

Mitchell J Nathan (University of Wisconsin-Madison)
Martha W Alibali (University of Wisconsin-Madison)
Matthew Wolfgram (University of Wisconsin-Madison)
Rachaya Srisurichan (University of Wisconsin-Madison)
Candace Walkington (University of Wisconsin-Madison)

Why is mathematics challenging for student learners? Based on an analysis of high school classes, we identified two central challenges to the development of mathematical ideas in STEM (science, technology, engineering and mathematics) education settings. First, STEM education involves fostering learners' ability to notice core mathematical relations among dramatically different modal engagements, which are

activities that involve different settings, participation structures, representations and material forms (e.g., working with equations, working with manipulatives). We identify this as The Challenge of the What of Mathematics. Second, experts such as teachers and curriculum developers may perceive cohesion across these various modal engagements, but learners often struggle to track mathematical concepts across these various encounters. We identify this as The Challenge of the Where of Mathematics. We used modal engagements analysis (MEA) to document these challenges in three high school classroom settings: technical education in beginning engineering (mechanics), precollege digital electronics, and college preparatory geometry. This work reveals that teachers and students produce cohesion (1) by projecting to past and future modal engagements, and (2) by coordinating representations and materials that are simultaneously present during modal engagements. Together, projection and coordination create opportunities to thread the mathematics through disparate representations, material forms and events.

3:00-4:15 PL04 Plenary Session 4 ..... Ballroom

How should we construe cultural diversity for the purposes of equitable education?

Andrea A diSessa (University of California – Berkeley)

Several influential approaches to equity in education aim to draw on culturally-specific "funds of knowledge." But, is it possible, instead, to build equitable education out of the commonalities that make us all human beings, instead of emphasizing differences? In this talk, I will (1) review the logic of building on culturally common knowledge, (2) defend the approach against claims of pervasive cultural difference, (3) talk about the advantages and disadvantages of such an approach, and (4) use classroom data to illustrate what such an approach might look like.

4:30-5:45 SY18 Symposium Session 18 ..... Belvedere

A learning progression approach to the reconceptualization of matter in elementary school

Organizer: Marianne Wiser (Clark University)
Organizer: Katie Frazier (Clark University)
Discussant: Sarah Michaels (Clark University)

A learning progression for matter is a hypothesis about how knowledge about matter could evolve, over several grade spans and with proper instruction, from young children's ideas about objects and liquids to the atomic-molecular theory (AMT). This Symposium addresses the elementary grade section of the learning progression (LPM), focusing on a scientific understanding of matter at the macroscopic level. Such an understanding is too often lacking, preventing students from understanding AMT.

The presentations highlight an important characteristic of LPM: it involves a series of deep reconceptualizations consisting of concurrent and mutually constraining changes in domain-specific, epistemological, and mathematical knowledge. Each reconceptualization results in a stepping stone—a coherent state of knowledge about matter that is conceptually closer to scientific understanding and helps students keep moving forward.

Paper 1 presents findings from the Inquiry Project in which a Grade 3-5 curriculum based on LPM was developed, implemented and tested longitudinally. Yearly interviews with students reveal significantly more progress in the Treatment group than the Control group toward achieving scientifically compatible concepts of material, weight, volume, and physical transformations, and a coherent conceptualization of matter. They also give evidence for the interconnections among different aspects of knowledge about matter.

Paper 2 focuses on the relation between the concepts of number and amount of material in 4-6 year-olds. Findings from a series of studies suggest that understanding the cardinal meaning of number is a later achievement than previously claimed, and is closely linked to integrating number words into a mental representation of magnitude. It precedes, and therefore may be necessary for, achieving a concept of amount of material.

Paper 3 presents a classroom intervention with kindergartners (and some preschoolers). Students practiced distinguishing between objects and materials and explored the effect of spatial transformations on amount of material, first with Lego assemblies then with rice poured into different shape vessels. Pre- and post-tests show significant gains in understanding the difference between properties of materials and objects, conservation of amount in Piagetian tasks, as well as in understanding cardinality. (A control group showed no significant gains).

Papers 2 and 3 suggest that the developments of the concepts of material and amount, measurement, and cardinality, may scaffold each other, and that curricular activities fostering their interactions may help young students develop a sound understanding of matter at the macroscopic. Together with Paper 1, they support the validity of learning progression as a theoretical construct and as an approach to science education.

Abstracting a general concept of matter among grade 3-5 students: Lessons from the Inquiry Project

Carol L Smith (University of Massachusetts)
Marianne Wiser (Clark University)
Sue Doubler (TERC)

How is the development of the concept of amount of material related to the development of the concept of number?

Doga Sonmez (Clark University)
Mariana Pradas (Clark University)
Marianne Wiser (Clark University)

Quantifying amount of material: A teaching intervention in preschool and kindergarten

Kathryn Frazier (Clark University)
Victoria Fox (Clark University)

4:30-5:45 SY19 Symposium Session 19.....Yerba Buena

Field studies of early learning: Home, school, & media

Organizer: Reed Stevens (Northwestern University)
Discussant: Richard Lehrer (Vanderbilt University)
Discussant: Leona Schauble (Vanderbilt University)

The dominant methods of developmental research over recent decades have been experimental. Laboratory studies offer assurances of statistical reliability, internal validity, and generalizability. What this dominant tradition lacks however is the capacity to adequately sample the range of ecological events and contexts in young children's lives and thereby document the "what" and "how" of naturally occurring learning and development. For this we need to directly sample the activities and settings of early childhood. The methods used in this symposium are ethnographic and the data are video-recordings of children's everyday activities at home playing, watching television, and engaged in various activities at pre-school. The goal of this symposium is to raise new questions at the intersection of STEM learning,

development, and socio-cultural practice. The specific goals of the symposium are three-fold: (1) to document the cultural, interactional, and material supports for STEM reasoning in the everyday activities of young children and their consociates, (2) to document the specific qualities of how children reason and what they reason about, and (3) to engage the question of how ethnographic field studies and experimental studies can complement each other in advancing developmental research.

The papers take a fresh field-based look at three familiar and critical issues in developmental research: (1) the role of children's questions in learning, (2) the comparative contributions of home and school as learning environments, and (3) learning with televised media. The first paper documents lines of question-based inquiry and reports on how these question sequences support STEM related learning. The second paper examines cultural supports for STEM reasoning in the everyday lives of children, how cultural supports from multiple settings offer complementary supports for STEM-related reasoning, and how children support each other's learning. The final paper presents a case study of interactions between siblings and a television program, in which children display STEM reasoning skills but only under particular conditions of social support. The combined effect of these papers is to partially map the socio-material arrangements and interactional routines that contribute to young children learning to participate in STEM reasoning.

Lines of question-based inquiry among young children
Lauren Penney (Northwestern University)
Reed Stevens (Northwestern University)

Building STEM foundations: Early STEM reasoning during two episodes of playing with blocks
Danielle Keifert (Northwestern University)
Reed Stevens (Northwestern University)

The development of television mediated scientific reasoning skills
Pryce Davis (Northwestern University)

4:30-5:45 SY20 Symposium Session 20.....Treasure

What we know affects how we think: belief and strategy in the development of reasoning

Organizer: Steve Croker (Illinois State University)
Organizer: Corinne Zimmerman (Illinois State University)
Discussant: Corinne Zimmerman (Illinois State University)

Scientific thinking and reasoning skills underpin achievement in science education. Moreover, the development of these skills is fundamental to becoming a scientifically literate adult. Research into children's scientific thinking and reasoning is multifaceted and includes the investigation of the formation and revision of theories and the principles of scientific inquiry (Zimmerman, 2007). The scientific reasoning process can be conceived of including hypothesis generation and testing, evidence evaluation, and experimental design skills (Klahr & Dunbar, 1988). In the three papers in this symposium, we discuss the reasoning abilities of children and adolescents studied in Germany, the UK, and the USA. We focus on three skills: (a) evidence evaluation, (b) hypothesis testing, and (c) hypothesis generation. In addition to examining these different reasoning competencies, we explore the conditions under which prior knowledge facilitates or inhibits sound reasoning.

The research presented in the first paper demonstrates that preschool children are able to revise their beliefs in the face of contradictory evidence, if the evidence is accompanied by an explanation for the pattern of evidence or a bar graph. For elementary school children, graphs led to greater belief revision

than explanations. Both types of information enable children to interpret patterns of covariation. The second paper examines the effects of prior belief on hypothesis testing, demonstrating that children and adults perform better in problem contexts in which there are no prior beliefs. These findings lend further support to the notion that scientific reasoning involves an interaction between domain-specific knowledge and domain-general reasoning strategies. The final paper presents empirical evidence from adolescents to support a theoretical distinction between conceptual and technical knowledge within scientific reasoning that provides an explanatory framework for the pattern of evidence presented by the other symposium participants. The findings from these three papers demonstrate that although basic skills and concepts necessary for scientific reasoning are present in childhood, performance can vary as a function of task characteristics and prior belief, and even adults lack some of the technical skills necessary for evaluating evidence.

Belief revision in response to evidence

Susanne Koerber (University of Education Freiburg)
Beate Sodian (University of Munich)
Daniela Huber (University of Munich)
Susanne Mikschl (University of Munich)

Prior belief, event outcome, and problem context affect children's strategy use when testing hypotheses

Steve Croker (Illinois State University)
Heather Buchanan (University of Nottingham)

Adolescents' conceptual and technical knowledge in proposing and evaluating hypotheses

Barbara Koslowski (Cornell University)

4:30-5:45 SY21 Symposium Session 21 ..... Angel

The dynamics of scaffolding

Organizer: P L C (Paul) van Geert (University of Groningen)
Organizer: H W (Henderien) Steenbeek (University of Groningen)
Discussant: Todd Rose (Center for Applied Special Technology)

Children learn from acting in and with environments that adapt – more or less optimally so – to their development-dependent abilities and properties. An example of such a type of process is scaffolding, which implies that an adult provides the child with the support that it needs to carry out an activity that it cannot yet carry out on its own and from which it can learn to carry out the act independently in the future. Scaffolding is a particularly good example of a coupled developmental dynamics: the short and long term change in the scaffold process depend on the change (developmental and learning effects) in the scaffolded process.

The three presentations provide examples of a process analysis of scaffolding dynamics in different contexts. The study of Küpers, Van Dijk and Van Geert deals with the co-construction of a Zone of Free Movement in individual music lessons. The teacher's challenge here is to restrict the degrees-of-freedom of the student while at the same time fostering the student's need for autonomy. Kupers,Van Dijk and Van Geert show that, while there are teacher-dependent differences, the degrees-of-freedom in the interaction increase as the student progresses. This means that the responsibility for learning is eventually given back to the student, which is an important characteristic of scaffolding.

Steenbeek and Jansen look at scaffolding during math lessons. The aim of their study is to get insight into how students' normal learning trajectories differ from problematic learning trajectories, due to students' psychiatric and behavioral problems. They show how characteristic differences in scaffolding between the two groups (for instance, differences in patterns of student's verbal actions and teacher feedback) may contribute to the emergence and maintenance of relatively dysfunctional scaffolding styles in children from special education.

Holodynski focuses on how the complex emotion of pride emerges in caregiver-child interactions during toddlerhood. While the stages of development of pride are known, there is no knowledge as to how children make the transition from one stage to the next. Therefore, Holodynski presents a conceptual framework by specifying Vygotsky's concept of the zone of actual and proximal development for effect- and achievement-related interactions between caregiver and child. His results show how a scaffolding process occurs during which the adult defines frames of action that run ahead of the child's actual frames, thereby validating the theoretical framework.

Rose will discuss the three presentations from the perspective of a dynamic process approach to understanding scaffolding.

Construction of a "zone of free movement" in individual music lessons

W E (Elisa) Küpers (University of Groningen)
M W G (Marijn) van Dijk (University of Groningen)

Scaffolding dynamics during instruction and its role in the emergence of problematic learning trajectories

H W Steenbeek (University of Groningen)
Louise Jansen (University of Groningen)

Emergence of pride in caregiver-child interactions during toddlerhood: A model of scaffolding in the zone of proximal development

Manfred Holodynski (Westfälische Wilhelms-Universität Münster)

4:30-5:45 SY22 Symposium Session 22 ..... Amador

Cultural approaches to talking science: How classroom discourse can position students as scientific thinkers

Organizer: Ellice A Forman (University of Pittsburgh)
Organizer: Randi Engle (University of California, Berkeley)
Discussant: James Greeno (University of Pittsburgh)

Intellectual movements within the field of science education are changing our notions of what it means to be a successful student. In the past, successful science students were asked to remember vast amounts of vocabulary and to follow the correct laboratory procedures. This approach to science education has been criticized by many educators as fostering a distorted sense of the nature of science to students. Often what is (unintentionally) communicated is that scientific knowledge consists of conclusions or that doing science involves tedious exercises in demonstrating those conclusions. In addition, students are positioned as passive recipients of knowledge from authoritative sources (the teacher and textbook).

In our initial attempts to position students as active learners, we focused on students' conceptual development or their use of the scientific method to reason about the logic of experiments. In the most recent phase, educational theorists and innovators have been engaging students in practices aligned with those of scientists such as argumentation, inscription, and modeling. The presenters in this symposium adopt

this latter practice-based approach to conceptualizing learning in science classrooms. By employing sociocultural learning theories and sociolinguistic analyses of classroom transcripts, we have been exploring the complex social and intellectual dynamics that occur in these classroom settings. Our aim is to document how expert teachers foster authentic scientific practices in their classroom and how they and their students engage with the concepts, tasks, and tools of designed environments to create scientific communities in the classroom.

Engaging in the discourse of science has the potential to change classroom authority structures and students' accountability to each other and to the discipline. It also may foster a genuine appreciation for the power of scientific inquiry. Nevertheless, communities of scientific practice, focused on argumentation, inscription and modeling, are not easily achieved in a classroom setting. The presenters in this symposium have been studying classrooms in which the teachers position their students as co-investigators of scientific phenomena and partners in developing and critiquing model-based arguments. We believe that detailed case study analyses of classroom discourse in these settings can help us better understand the adaptive pedagogical expertise of effective teachers as well as the learning processes of students as they participate in productive disciplinary engagement.

Possible worlds, possible meanings: Working language in the science classroom
Beth Warren (TERC)
Ann Rosebery (TERC)

Authoring storylines during a biology classroom lesson
Ellice Forman (University of Pittsburgh)
Linda Deafenbaugh (University of Pittsburgh)
Barbara Barnhart (University of Pittsburgh)
Michelle Cheyne (University of Pittsburgh)

Activity structures, positionalities and discourse: Two students' participation across two years of school
Lindsay Cornelius (University of Washington)
Leslie Herrenkohl (University of Washington)

4:30-5:45 PS15 Paper Session 15..... El Dorado

Social Interaction & Development

Chair: Jennifer M Langer-Osuna (University of Miami)

An investigation of the conditions under which procedural content enhances conceptual self-explanation in mathematics
Annick Lévesque (Concordia University)
Helena P Osana (Concordia University)

The benefits of self-explanation on the learning of mathematical concepts and procedures are well documented. In this study, we investigated the conditions that impact the generation of second-graders' self-explanations in the context of learning concepts through procedures. The objective was to examine the interactive effects of task demand and prior numeracy knowledge on the quantity and quality of second-graders' self-explanations about procedures involving addition and place value. We designed three tasks to test different hypotheses related to the generation of their self-explanations. The first was designed to test the effects of high cognitive demand, the second task was minimally demanding, and the third was designed to test the effects of cognitive conflict (i.e., surprise) on self-explanation. A repeated

measures design was used with a sample of 30 second-grade students who were videotaped working on the three tasks. Self-explanations were coded for quantity and quality. Results confirmed that task demands affect the quantity and quality of self-explanations with a moderating effect of prior numeracy knowledge. Specifically, the data revealed that low prior knowledge students generated higher quality self-explanation (i.e., conceptual) on the cognitively-demanding task whereas high prior knowledge students produced better quality self-explanations on the task based on cognitive conflict.

Elementary students' development of epistemic understanding of scientific argument

Suna Ryu (University of California, Los Angeles)
William A Sandoval (University of California, Los Angeles)

This paper explores the appropriation process of argumentation norms and examines how the process helps students to improve their epistemic understanding of what makes a scientific argument. Recent science studies emphasize that epistemic understanding evolves through appropriating the norms of the relevant community by making efforts to satisfy norms via social interaction. Methodologically, I draw on Paul Cobb's work to conceptualize the process of developing norms in classroom contexts. Based on this framework, I traced how norms for argumentation are initiated, negotiated, and appropriated. I observed and videotaped every science lesson in a mixed 3rd and 4th grade class over the school year (2009-10), and described the refining and negotiating process used in establishing argumentation norms. In addition, I designed and validated an argument construction and an evaluation assessment. Students completed both tasks at the beginning of the school year and at the end. These assessments were conducted to gather evidence of each student's enhanced understanding of epistemic criteria, which relates to the ability to apply norms in different contexts. The results show that the practice of appropriating argumentation norms contributed to the improvement of students' epistemic understanding.

Examining the interactive construction of authority in bilingual students' group mathematical discussions

William Zahner (University of California Santa Cruz)

This study of the construction of authority in small group interactions is rooted in a larger study that examines the development of bilingual algebra students' reasoning about rate, slope, and linear functions during a classroom unit on these topics. In the overall study I focus on student learning through small group discussions using a sociocultural framework to define learning. Prior mathematics education research on classroom group work has identified authority as a key element of student learning, where equitable relations of authority are considered optimal (Cobb, 1995; Esmonde, 2009). Here I present a framework for analyzing the interactive construction of authority within small group mathematical discussions based on methods from classroom discourse analysis. I then apply that framework to a series of six mathematical discussions among the two focal groups of students. Preliminary findings from this study indicate that there may be more open disagreement and longer discussions in groups with balanced authority.

Capitalizing on culture in the classroom: A theoretical and empirical review

Briana M Hinga (University of California – Irvine)

Many leading scholars and a great deal of research support the theory that learning built on shared experiences between individuals is particularly rich. First, because knowledge can not be separated from sociocultural influences (Vygotsky, 1978); personal experiences act as the foundation for learning. Second, collaboration among individuals with differing experiences creates a fertile environment for learning, where contradictory perspectives can be considered and new ideas can emerge. However, most implementation of and research on collaborative learning environments has been limited to out of school settings, rather than within schools, even though today's classrooms provide a valuable opportu-

nity for collaborative learning. The current review of the literature examines attempts to build learning environments based on shared experiences in school settings. A synthesis of findings reveals that learning environments based on shared experiences in schools are linked to many educational benefits, including increases in students' motivation and improvements in learning processes. This synthesis also includes a discussion of obstacles to bringing collaborative learning into classrooms and gaps in the literature. The review is aimed to move forward the conversation about collaborative learning within classrooms.

Understanding the development of student authority in cooperative mathematics classrooms and its relationship to engagement in mathematical discussions

Jennifer M Langer-Osuna (University of Miami)

Understanding how students become positioned with authority is important to the goal of supporting productive student-led mathematical discussions. This paper will examine the development of student authority during collaborative mathematical tasks, and its role in supporting student engagement. Student authority is understood by analyzing across three cases wherein the development of student authority (a) supported a dramatic positive shift in a student's engagement in classroom activity; (b) negatively impacted a students' engagement in classroom activity; and (c) affected group members' differential engagement in mathematical discussions in complicated ways. Specifically, this paper addresses the following questions: how does student authority develop during collaborative tasks in mathematics classrooms? What is the role of student authority in supporting productive engagement in mathematical tasks, and, thereby, opportunities to learn mathematics? A focus across three case studies analyzed separately elsewhere (Esmonde & Langer-Osuna, in Press; Langer-Osuna, in Press; Langer-Osuna, 2009) highlights how classrooms that afford student agency allow students to draw on their own out-of-school lives in ways that enable or constrain the development of student authority. In addition, being positioned positively or negatively with respect to authority impacts students' patterns of engagement in mathematical discussions.

4:30-5:45 PS16 Paper Session 16.....Mariposa

Topics in Science Learning

Chair: Brian D Cox (Hofstra University)

Modeling to develop ecological explanations

Eve Manz (Vanderbilt University)

In this paper, I argue that students can be supported in developing ecological ways of seeing and thinking through carefully guided modeling practices. I report on a design study conducted with urban third graders in a wild backyard area. Instruction was guided by the focusing question, "How did all these kinds of plants get here and why are there different plants in different places?" Analysis of pre- and post-interviews shows that children apply to natural settings lenses that entail the visibility of different variables and relationships. These lenses range from a focus on human agency or nature-based agency at the level of association to several mechanisms for nature-agency, including the relationship between conditions of a place and the needs of organisms. Instructional design was driven by 1) consideration of how models might amplify variables and relationships, supporting particular disciplinary lenses and 2) the maintenance of connections between modeling practices and the focal enterprise of understanding the backyard. Post-interview analysis showed that, through instruction, students had come to see and apply new variables to construct explanations about the backyard. One highly successful modeling practice and resulting shifts in student thinking is explored.

Promoting self-esteem and perceived competence in science in girls

Christine T Schuette (Regent University)
Jenny Sue Flannagan (Regent University)

A study will be reviewed which investigated whether a workshop series developed by the Girl Scout Research Institute and Dove effected a change in girls' self-perceptions of their abilities in three domains (physical, social, and cognitive). Additionally, we explored whether providing opportunities for girls to engage in science experimentation increased their perceived competence in science. Participants were from three different Girl Scout troops, and ranged in age from 8-12. The focus will be on the educational implications for parents and teachers and ways that they can empower more girls to handle peer pressure, to understand the media's negative influence, and to have an overall healthier body image. Finally, the impact of the workshops on girls' career self-efficacy in regard to future occupations in science will be discussed.

Persuading with visual evidence in scientific argumentation: Two middle school students' dispute over global temperature change

Camillia Matuk (University of California – Berkeley)

Persuading others of scientific explanations is a key process in scientific inquiry (Sandoval & Millwood, 2005). Visual representations can be powerful evidence, but their interpretation is mediated by various factors, including individual expectations and prior knowledge. This study examines a discursive episode between two middle-school students who collaborated on a computer-supported inquiry module on climate change. In the episode, the students attempted to persuade one another of their differing perceptions of a graph of global temperature over Earth's history. Through a microgenetic analysis of their discourse, we see how different parts of the same visual artifact were more or less salient depending on the students' individual experiences, and as a result, became pivotal to their contrasting claims. We discuss the students' strategies for persuading one another of their perceptions, and the various rhetorical uses of visual evidence to back their claims. In light of our analysis, we reflect on possible designs for effective instructional and technological scaffolds for productive argumentative behaviors; as well as supports for students to make and persuade others of connections between claims and visual evidence.

The California preschool learning foundations in science: A cultural tool to guide and support preschool science education

Osnat Zur (WestEd)
Peter Mangione (WestEd)

Psychologists, educators, and policy-makers share the view that science is a natural and developmentally appropriate activity for young children, and recognize the importance of initiating science education as early as possible. To implement early science education on a wide scale in an effective way, the field of early childhood education needs to have a clear vision and a set of goals for children's early learning of scientific skills and knowledge. One way to guide curriculum and practice of early science education is through the provision of clearly defined age-appropriate expectations or standards in science. A set of preschool foundations in the domain of science provides a cultural tool to guide and support the development of a curriculum framework, assessment items, and instructional materials in early science education. Recently, the state of California articulated preschool learning foundations in the domain of science. Informed by research in psychology and education, the foundations describe the scientific knowledge and skills most children demonstrate around 48 and 60 months of age. The paper describes (a) the theoretical framework that guided the development of the preschool science foundations, one

that is consistent with a Piagetian approach and a constructivist perspective on learning (b) key scientific concepts and skills that are included in the foundations.

5:45-6:00 break

6:00-6:30 PT03 Poster Session 3 .....Quarter Deck

Poster Session 3

Posters should be mounted in the Quarter Deck room during the lunch break on Friday, to allow viewing during the afternoon. Authors will be present during the evening poster session (6:00–6:30). Posters should be removed at the end of the session (6:30).

1. *Verbal and nonverbal communication: Which tells the richer story?*
   Saba Ayman-Nolley (Northeastern Illinois University)
   Christopher Bennett (Northeastern Illinois University)
2. *Effects of mood on children's stigmatization of overweight peers*
   Candace Lassiter (University of North Carolina – Greensboro)
   Janet Boseovski (University of North Carolina – Greensboro)
3. *Probing mathematical abilities in children with Autism Spectrum Disorder: Two case studies*
   Carley Piatt (University of Alberta)
   Joanne Volden (University of Alberta)
   Jeffrey Bisanz (University of Alberta)
4. *A consideration of a common conceptual basis for understanding different kinds of combinatorial problems*
   Takako Sakawaki (Waseda University)
5. *Communicating norms to young toddlers: A home observation study of verbal and emotional responses to transgressions in the second year of life*
   Audun Dahl (University of California, Berkeley)
   Elliot Turiel (University of California, Berkeley)
   Joseph J Campos (University of California, Berkeley)
6. *The overestimation error: Further evidence for post-false belief development in theory of mind*
   Christina Harvey (University of California – Davis)
   Liat Sayfan (University of California – Davis)
7. *The influence of parental math self efficacy and attitudes, and personal self efficacy on the math literacy performance of African American students*
   Yvette R Harris (Miami University)
   Valarie M Schroeder (Miami University)
8. *Creating mathematical models of real world situations: An exploration of individual differences*
   Kristie J Fisher (University of Washington)
   Miriam Bassok (University of Washington)
9. *Construction of ecological explanations: understanding scientific reasoning in content-rich environments*
   Eve Manz (Vanderbilt University)

10. *Four-year olds are irrational hyper-imitators, while 3-year olds are rational emulators*
    Francys Subiaul (The George Washington University)

11. *Linking delay of gratification and persistence in preschool children*
    Joshua B Harrod (University of Minnesota)
    Stephanie M Carlson (University of Minnesota)
    Angela Lee Duckworth (University of Pennsylvania)
    Walter Mischel (Columbia University)

12. *Mathematics teachers' beliefs and their effect on classroom culture*
    Hee-jeong Kim (University of California – Berkeley)

13. *Science vs. the science classroom: Epistemological dilemmas*
    Jen Arner Welsh (Quinsigamond Community College)

14. *Labeling effects in reasoning about biology, race, and violence*
    Jessica W Giles (University of Colorado – Boulder)
    Corey E Sullivan (Vanderbilt University)

15. *Parenting style and children's emotion physiology: The moderating role of child temperament and emotional context*
    Jonas G Miller (University of California – Davis)
    Paul D Hastings (University of California – Davis)

16. *Mapping science students' meta-representational knowledge about photographs of landscapes*
    Jon Boxerman (Northwestern University)
    Bruce Sherin (Northwestern University)

17. *Clarifying evaluativism or advanced personal epistemology: Implications for theory, research and practice*
    Lisa D Bendixen (UNLV)
    Deanna C Rule (UNLV)

18. *Infant frontal encephalogram (EEG) alpha power and behavioral response to jealousy*
    Beren Avci (York University)
    Maria Legerstee (York University)
    David Haley (University of Toronto)
    Vadim Poliansky (York University)

19. *Students' understanding of altruism evolution as emergent phenomena: a microgenetic analysis*
    Mario Córdoba (Universidad de los Andes)

20. *Links between parents' epistemological stance and young children's talk about evidence and explanation*
    Sarah Smilovic (University of California, Santa Cruz)
    Megan Luce (University of California, Santa Cruz)

6:45-7:15 PT04 Poster Session 4 .....Quarter Deck

Poster Session 4

Posters should be mounted in the Quarter Deck room at the end of Poster Session 3 (6:30). Authors will be present during the evening poster session (6:45–7:15). Posters may remain mounted after the session but must be removed at the end of the evening.

Friday—P.M.

1. *Do bilingual children perform better on a number-estimation task?*
   Meghan Goldman (University of California – Irvine)
   James Negen (University of California – Irvine)
   Barbara W Sarnecka (University of California – Irvine)
2. *How far does the apple fall from the tree? Daughter-mother disagreements in the Turkish urban contexts*
   Melike Acar (UC Berkeley)
3. *Gesture and individual differences in mental abacus performance*
   Neon Brooks (The University of Chicago)
   Michael Frank (Stanford University)
   David Barner (University of California, San Diego)
4. *A longitudinal study of personal drawing style as narrative theme and artistic resourcefulness*
   Peter B Pufall (Smith College)
   Emma Coleman (Smith College)
   Christina Nelson (Smith College)
5. *Children developing an ability to move between frames of reference in astronomy: Towards a learning progression in celestial motion*
   Julia D Plummer (Arcadia University)
   Alicia Kocareli (Arcadia University)
   Cynthia Slagle (Colonial School District)
6. *Working at thought: Children's understanding of objective and subjective influences on belief*
   Carrie Pritchard (Western Kentucky University)
7. *The role of attachment and language in analogical reasoning*
   Tamra Cater (University of Southern Mississippi)
   Alexander Biondolillo (University of Southern Mississippi)
   Jennifer Vonk (University of Southern Mississippi)
8. *Regulatory processes in literacy learning*
   Lynda Stone (California State University, Sacramento)
   Rita Stoeckl (California State University, Sacramento)
9. *The relationship between affective perspective-taking and dispositional versus situational empathy*
   Sadaf Lotfalian (University of British Columbia)
   Tracy Cassels (University of British Columbia)
   Joyce Lui (University of British Columbia)
   Sophia Ongley (University of British Columbia)
10. *Do people talk about emotions at home? A study on family communication*
    Lídia Suzana Rocha de Macedo (Universidade Federal do Rio Grande do Sul)
    Tania Mara Sperb (Universidade Federal do Rio Grande do Sul)
11. *Interpersonal problem solving and make believe play in preschool boys and girls*
    Sarah Landry (Université Laval)
    Pierre Pagé (Université Laval)

12. *Children designers*
    Robert J Rouse (Vanderbilt University)
13. *The development of inhibitory control in early childhood: Differential trajectories predicted by early externalizing problems and parasympathetic regulation*
    Sarah Kahle (UC Davis)
    William T Utendale (University of Calgary)
14. *Does parental ratings of Executive Function predict problem behaviors in preschool children?*
    Sarah Hutchison (University of Victoria)
15. *Developmental implications of mother-child reminiscing in adolescence*
    Trisha Weeks (University of Utah)
16. *Sex differences in infants' visual interest in toys versus real objects*
    Rahman Zolfaghari (UCLA)
    Paola Escudero (UCLA)
    Scott Johnson (UCLA)
17. *Exploring children's developing conceptions of fairness with the Distributive Justice Scale*
    Michael Binetsch (Saint Louis University)
    Bryan Bander (Saint Louis University)
18. *Identifying a transitional level between false belief understanding and an interpretive Theory of Mind*
    Emily Price (Saint Louis University)
    Mary E Herbst (Saint Louis University)
19. *Notes on the "Latino Paradox": Conceptualizing connections among family socialization processes, cognitive development, and achievement*
    Rose Cartwright (University of California – Berkeley)
20. *Of two minds: Speech and gesture as an index of the simultaneous activation of two language systems*
    R B Church (Northeastern Illinois University)
    Shahrzad Mahootian (Northeastern Illinois University)
    Ivelisse Burgo (Northeastern Illinois University)

6:30-7:30 REC2 Jacobs Foundation Reception for Emerging Scholars .....Islands Ballroom

Jacobs Foundation Reception of Emerging Scholars

Please join us for a special reception to recognize the contribution of new and emerging scholars (pre-tenure faculty, post-docs, and graduate students) from across the many participating countries who are attending this year's meeting. We will also take a moment to announce the recipients of this year's Peter Pufall and Jacobs Foundation Emerging Scholar Travel Awards. Following the brief award presentation, there will be plenty of time for mingling with old friends and new acquaintances. Appetizers will be served and a cash bar will be available.

Friday—P.M.

7:30-8:30 MRES Mentor Roundtables for Emerging Scholars Session.....Mariposa

Mentor Roundtables for Emerging Scholars

The Jean Piaget Society Emerging Scholars Committee is hosting a series of roundtable discussions between new scholars (graduate scholars, post docs, or pre-tenured faculty) together with more senior scholars. A total of four working spaces (6 students per table) will be facilitated by senior scholars with expertise in the following areas:

1. Establishing a research agenda.
2. Qualitative and ethnographic research in developmental psychology.
3. Professional development: How and where to publish in the field?
4. Professional development: Women in academia: Preparing for work/family balance.
5. Professional development: How to find a job or post-doc

Space is limited. If you have not pre-registered for this session, please contact Ayelet Lahat (alahat@umd.edu), or talk to our volunteers at the registration desk.

9:00- Returning Emerging Scholars Dinner.....TBA

Returning Emerging Scholars Dinner

The JPS Emerging Scholars Committee invites all returning emerging scholars presenting at this year's meeting to join their peers—and some special guests—for an informal dinner on Friday evening. We will meet at 8:45 at the registration desk. This is an opportunity to meet other returning students, postdocs, early career scholars, and network with some of the society's senior scholars. The dinner will be hosted by Matthew Gingo (gingo@berkeley.edu) and Irenka Domínguez-Pareto (idpareto@berkeley.edu).

8:00-9:00 RT03 Roundtable Session 3 ..... Angel

Childhood & Education

Chair: Saba Ayman-Nolley (Northeastern Illinios University)

Dynamic aspects of young children's cognitive planning
Marlenny Guevara Guerrero (Universidad Tecnológica de Bolívar)
Rebeca Puche-Navarro (Universidad del Valle)
Mónica Roncancio Moreno (Universidad del Valle)

Planning for reasoning: Mapping potential pathways for learning through argument-based inquiry
Mary Grace F Villanueva (University of Iowa)
Brian Hand (University of Iowa)

Epistemology of mathematics education versus Epistemology of mathematics: A current debate in the framework of epistemology of imagination
Carmen Patricia Rosas-Colín (CINVESTAV-IPN)
Luis Mauricio Rodríguez-Salazar (CIECAS-IPN)
Malaquías Martín Castilla-Hernández (CICS-CIECAS-IPN)

Exploring the relation between learning and development
Malcolm Cunningham (University of Toronto)
Yukari Okamoto (University of California, Santa Barbara)

Comparison vs. problem-solution writing tasks: The issues at play in early grades
Renée Gagnon (Université du Québec à Trois-Rivières)
Hélène Ziarko (Université Laval)

8:00-9:00 PS17 Paper Session 17 ..... Amador

Science Education

Chair: Susan L Golbeck (Rutgers, The State University of New Jersey)

Trajectories of conceptual change in evolutionary biology
Andrew Shtulman (Occidental College)
Prassede Calabi (University of Massachusetts Boston)

Conceptual change involves more than just a quantitative increase in knowledge; it involves a qualitative restructuring of that knowledge. In this talk, we will present research on a conceptual change that many college-educated adults fail to make: the transition from an essentialist, need-based theory of evolution to a genetic, selection-based theory. College undergraduates enrolled in a course on evolution and ecology (n = 188) completed inferential-reasoning tasks designed to assess their understanding of six evolutionary phenomena: variation, inheritance, adaptation, domestication, speciation, and extinction. Content analyses were used to differentiate correct, selection-based conceptions from incorrect, need-based conceptions, which were then coded along a three-point numeric scale. Comparison of these measures across instruction revealed a consistent decoupling of microevolutionary concepts from macroevolutionary concepts in participants' progress toward achieving conceptual change. This decoupling has not been observed in previous studies within the same domain, either by those employing strictly qualitative methods or by those employing strictly quantitative methods, suggesting (a) that "tree thinking" and "population thinking" are different conceptual competencies requiring different instructional interventions

and (b) that the combined use of quantitative and qualitative measures for assessing conceptual-change learning may capture nuances of that learning not captured by either method on its own.

Exploring the use of conceptual metaphors in solving problems on entropy

Fredrik Jeppsson (Linköping University)
Jesper Haglund (Linköping University)
Tamer G Amin (Lebanese American University)
Helge Strömdahl (Linköping University)

A body of research on conceptual change adopting a "resource" or "knowledge-in-pieces" perspective has sought to characterize abstract scientific understanding and reasoning in terms of intuitive knowledge resources available to learners. Research in cognitive linguistics has identified many metaphorical mappings between abstract concepts and experiential source domains ("conceptual metaphors") implicit in everyday and technical language. In this paper, the theory of conceptual metaphor was used as a framework in order to characterize the use of metaphors when two physical chemistry PhD students together solved problems related to the concept of entropy. Based on a detailed analysis of a verbatim transcript of the problem-solving session, a variety of uses of conceptual metaphors were identified: multiple metaphors were coordinated maintaining consistency across the source domains of the metaphors used, a single metaphor was used in a sustained way throughout a reasoning segment, and commitment to certain scientific ideas encouraged application of conceptual metaphors not seen to be intuitively applicable at first. In general, we see our findings as contributing to the characterization of the nature and role of the many intuitive knowledge elements that must be coordinated to understand and reason with a scientific concept.

Capturing content and context effects on engagement with science learning

Meghan Bathgate (University of Pittsburgh)
Lisa Brahms (University of Pittsburgh)
Christian Schunn (University of Pittsburgh)
Kevin Crowley (University of Pittsburgh)

Our current research involves the validation of a child survey instrument assessing overall student engagement towards science in relation to internal factors (identity with science, persistence, motivation, curiosity, and interest in science, responsibility for learning, appreciation for the value of science, and capability for performing science), science learning context (formal and informal science settings), and content (different broad science topics). Through balancing survey items by context and topic, we may examine the influence of these factors in relation to each other and to the internal characteristics of children. We will present our findings from 200 6th grade students, across a variety of topics in both formal and informal contexts. Results will include behavioral validation of children's level of participation in science related activities via parent and teacher surveys, along with child interviews. The data will provide an in-depth view of the child in relation to science learning contexts and topics. We will also discuss the larger longitudinal scope of our project that affords us the opportunity to examine how internal factors persist or adjust through the course of a child's development in scientific reasoning.

Children's understanding of physical movement

Hebbah El-Moslimany (Rutgers, The State University of New Jersey)
Susan L Golbeck (Rutgers, The State University of New Jersey)

Previous studies on science education in elementary and preschool (see Metz, 2004, 2008; French, 2004; Gelman & Brenneman, 2004) provide a discussion of how science can be introduced to young children through a hands-on, student-centered approach with an emphasis on inquiry. Creating a curricu-

lum with an emphasis on inquiry is challenging, but is necessary in order for children to have a deeper understanding of various science topics because inquiry allows a child to question, reflect, communicate ideas, and solve problems (NRC, 1996, 2007). In order to help with the design of science curricula, designers and classroom teachers need to focus on young children's understanding of concepts in both the biological and physical sciences, and predictable patterns found in children's conceptual growth. In this paper we describe a project designed to map out the developmental trajectory or sequence, in children's understanding of physical movements within the context of a simple machine– gears. Our project explores children, between the age of 4-7 years, understanding of movement, and asks the children to predict the direction a gear will move in, and then explain their reasoning about movement. Preliminary analysis suggests that there is a shift in children's understanding of movement.

8:00-9:00 PS18 Paper Session 18..... El Dorado

Math

Chair: Peter C Cormas (Providence College)

An evolved psychological structure for mathematical division

Peter C Cormas (Providence College)
Meaghan Fox (Providence College)
Nicole Sabatino (Providence College)

Research has shown that very young children have the ability to solve difficult division problems before formal school-based instruction. This is accomplished by solving division word problems by an interesting act that resembles sharing, and is known as dealing. This phenomenon has been central to the idea that sharing maybe the origin of mathematical division, yet a thorough theory has never been examined or formulated. The theory set forth in this manuscript is that an evolved psychological structure, one that allowed our humans ancestors to share food, is the origin of mathematical division. This theory is supported by evidence of quantitative abilities in humans and animals, a specialized action scheme for dealing in specific situations, a pancultural ability for young children to solve division problems through dealing, food sharing behaviors in human and nonhuman primates, and egalitarian abilities. This structure was co-opted by culture and build upon to create formal mathematical division.

How do American and Japanese mothers teach the concept of addition to their 4-year-old children?

Wakasa Nagakura (Columbia University)

This paper examines how American and Japanese mothers teach the concept of addition to their 4-year-old children. The data for 39 mother-child dyads–20 American and 19 Japanese–was a part of a larger comparative study of parental teaching practices. In the informal addition task, a mother asks her child a story problem of addition. In the formal addition task, the mother asks her child to choose the correct equation that matches the story problem. After the mother gets responses from her child, the method for teaching was the mother's decision. The interactions were videotaped and nine teaching style codes were applied to the transcripts. A comparison of teaching styles between American and Japanese mother-child dyads found two interesting patterns: Both groups of mothers use "Elaborate questioning" and "Clarifying child's responses" most. Significant differences are American mothers' preferential use of "directive talk" and Japanese mothers' preferential use of "modeling." The author argues that "child-centered" teaching practices such as modeling and elaborate- questioning would be more effective than "didactic" teaching to stimulate a child's thinking. Mothers must use sensitive assessments and be flexible during teaching interactions. Cultural comparisons reveals the subtle differences in their interactions.

Analysis of tasks for development of mathematical reasoning

Marty McCall (Northwest Evaluation Association)
Josephine Rodriguez (Northwest Evaluation Association)

This paper investigates student interaction with tasks using a framework of cognitive science applied to assessment design. The goal is to see patterns of interaction that show learning and specific misconceptions or skill gaps that can be used to enhance teaching and learning. Cognitive theories embodied in Standards for Mathematical Practice of the Common Core State Standards for Mathematics are used to characterize tasks. The tasks are designed to elicit information about abstract reasoning, representation, and problem solving in early elementary school students. Tasks are presented to students and analyzed using a feature-matrix statistical method. Observed response patterns are examined to see whether they confirm theoretical expectation. The ultimate purpose is to provide information about the state of individual student mastery. The set of responses for an individual student informs instruction by showing specific strengths and weaknesses in mathematics tasks.

8:00-9:00 SY23 Symposium Session 23 ..... Mariposa

The role of executive function in the development of children's prospective memory

Organizer: Caitlin Mahy (University of Oregon)
Organizer: Matthias Kliegel (Technische Universität Dresden)
Discussant: Stephanie Carlson (Institute of Child Development)

Prospective memory (PM) refers to the processes associated with the formation and delayed realization of intended actions (e.g., remembering to pass a message to a teacher at school). It is a critical ability for children's successful social and academic functioning. The development of children's PM has been understudied, especially in contrast with research on ageing populations. In theories of adult PM, besides retrospective memory for the intention content, executive functions (EF) have been suggested to play a role in PM (especially in the context of intention planning, and monitoring for the prospective cue). However, surprisingly little work has investigated the role of EF in children's PM development. The current symposium will address these issues by presenting both experimental and individual differences research. Three international researchers will present current data and discuss methodological and theoretical advances. The papers will present (1) three experiments that systematically test the Multiprocess theory of PM on school-aged children which reveal age-related changes in PM dependent on executive task demands, (2) two studies investigating the role of EF and theory of mind in 4- to 6-year-olds' PM revealing that inhibition and theory of mind independently contribute to children's PM, (3) two individual difference studies examining the relations among working memory, planning, future thinking, theory of mind, and PM in 4- to 6-year-olds that demonstrates robust relations among these future-oriented abilities. Dr. Stephanie Carlson will discuss the findings in the broader context of memory development, development of executive control and prefrontal functioning.

Automatic and controlled processes in prospective memory development

Matthias Kliegel (Technische Universität Dresden)

Executive and theory-of-mind contributions to event-based prospective memory in young children

Ruth Ford (Griffith University)
Tim Driscoll (Griffith University)
David Shum (Griffith University)
Catrin Macaulay (Swansea University)

Individual differences in prospective memory development: The role of working memory
Caitlin Mahy (University of Oregon)
Louis Moses (University of Oregon)

9:00-10:30 IS04 Invited Symposium Session 4.....Belvedere

Difference, culture, and distribution in mathematics and science learning

Organizer: Rogers Hall (Vanderbilt University)
Discussant: Na'ilah Nasir (University of California, Berkeley)

This symposium brings together new research on mathematics and science learning with a focus on difference, cultural values, and distributions of activity across formal and informal settings. The papers address a variety of questions: What counts as knowledge in STEM domains when we look outside the classroom? How do learners' activities bring these conceptual domains to life in ways that reflect their biographies and possibilities for development? How does one's personal biography relate to issues of social justice and equitable opportunities to learn? How is learning at the individual level articulated with processes of social or technical development at collective or ensemble levels of analysis? We are fortunate to have Nai'ilah Nasir as a discussant, a scholar whose work touches on many of these questions.

Relational epistemologies in indigenous communities: Implications for rethinking science learning trajectories
Megan Bang (TERC)
Ananda Marin (Northwestern University)
Douglas Medin (Northwestern University)

The primary interactive pathway: Examining the role of activity in re-framing audience and representations in early elementary science classrooms
Joshua A Danish (Indiana University)
Asmalina Saleh (Indiana University)

Affluent students making sense of mathematics and social justice
Indigo Esmonde (University of Toronto)

Learning a part together: Participant learning trajectories with ensemble spatial forms in a high school marching band
Rogers Hall (Vanderbilt University)
Jasmine Ma (Vanderbilt University)

9:00-10:30 SY24 Symposium Session 24.....Yerba Buena

Science and math: Multiple approaches to teaching and learning

Organizer: Zena Eisenberg (Pontifícia Universidade Católica do Rio de Janeiro - PUC-Rio)
Organizer: Dominique Colinvaux (Universidade Federal Fluminense - UFF)

The Symposium is broadly concerned with science and mathematical education from multiple perspectives. The common thread focuses on learning processes. Variations occur as to who learns: different groups, namely professional teachers and young adolescent students; and what is learned: geometry, the notion of time, mathematics (Cartesian product), science in general. The Symposium looks into how teachers teach science and math to young children enrolled in early education and elementary schools in Brazil. The Symposium includes four papers. The first one, by Eisenberg & Colinvaux, looks into primary school teachers' understanding of the notion of time and how they plan teaching activities for their

students. The second paper, by Brito & Sodré, explores teachers´ views on the existence of geometrical knowledge in early education regular activities. The third paper, by Aquino, Vasconcellos & Colinvaux, proposes a course to early education teachers as a strategy to help them introduce science issues in their classrooms. The fourth paper, by Moro, Soares & Spinillo, focuses on 5th to 8th graders learning processes concerning mathematical problems of Cartesian products.

Giving time its due time: When and how do we teach elementary school children about time?
Zena Eisenberg (Pontifícia Universidade Católica do Rio de Janeiro - PUC-Rio)
Dominique Colinvaux (Universidade Federal Fluminense - UFF)

Geometry in early education from a teacher´s perspective
Mirian Ferreira de Brito (Universidade do Estado da Bahia)
Liana Gonçalves Pontes Sodré (Universidade do Estado da Bahia)

Early childhood education teachers´ views on science
Ligia Maria Leão de Aquino (Universidade do Estado do Rio de Janeiro)
Vera M R de Vasconcellos (Universidade do Estado do Rio de Janeiro)
Dominique Colinvaux (Universidade Federal Fluminense - UFF)

The grasp of consciousness and performance on solving mathematical problems of Cartesian product
Maria Lucia Faria Moro (Universidade Federal do Paraná)
Maria Tereza Carneiro Soares (Universidade Federal do Paraná)
Alina Galvão Spinillo (Universidade Federal de Pernambuco)

9:00-10:30 SY25 Symposium Session 25 ..... Treasure

Critical perspectives on learning progressions

Organizer: Mark Wilson (UC Berkeley)
Discussant: Carol Smith (University of Massachusetts – Boston)

Learning progressions have been widely appropriated in the research and educational communities, albeit with widely different conceptualizations of their nature, their purpose(s), their derivation, and degree to which they entail divergence from prevailing models of curriculum scope and sequence.

This symposium takes as a starting point, the assumptions about learning progressions articulated in the two NRC reports, Systems for State Science Assessments (NRC, 2006) and Taking Science to School (NRÇ, 2007), and looks to provide critical perspectives on the current state of learning progressions, and their future(s). For example, one group has put forward the following as a definition:

Learning progressions are descriptions of the successively more sophisticated ways of thinking about an important domain of knowledge and practice that can follow one another as children learn about and investigate a topic over a broad span of time. They are crucially dependent on instructional practices if they are to occur. (CCI, 2009)

This definition emphasizes that a learning progression is a model of the internal states of a student. It seems to place instructional aspects outside of the learning progression (i.e., "dependent upon"). However, in an alternative view, the instructional aspects should be integrated into the learning progression. Beyond that, one might also speculate about the relationship between a learning progression and the assessments of its outcomes for children.

Presenters at this symposium will examine the adequacy of the reports' perspective on learning progressions and needed changes and/or elaborations to the construct for the purpose of advancing the reform of science education. The three speakers will give critical perspectives on different aspects of learning progressions, including the relationships among the three aspects mentioned in the previous paragraph (i.e., developmental, instructional and assessment aspects), the relationships between the learning progression and the 4-strand model of scientific proficiency, and the complexities of assessing the outcomes of a learning progression. (see individual summaries below)

Following the three presentations, a distinguished discussant will critically review the perspectives given in the papers, adding his/her own views, and appraise the importance of these for the future of education and educational research. Ample time will be left at the end for discussion and question and answer from the audience.

Developing professional vision
Rich Lehrer (Vanderbilt University)

Rethinking learning progressions as increasing explanative power from the child's point of view
Kathleen Metz (UC Berkeley)

Linking dimensions in an outcome progression
Mark Wilson (UC Berkeley)

9:00-10:30 SY26 Symposium Session 26 ..... Angel

Children's attributions and experiences of sociomoral emotion

Organizer: Craig E Smith (Harvard University)

Children's anticipation and attribution of sociomoral emotions have received a good deal of attention over the past two decades. A key finding in this area of research is that young children often attribute positive emotions to transgressors who get what they want, while older children are more likely to attribute guilt and mixed emotions (Arsenio & Kramer, 1992). Continued research has refined early findings (e.g., children are more likely to anticipate guilt following questions about the self as a transgressor, compared to questions about a third party as a transgressor; Keller et al., 2003). The relevance of this area of research has been underlined by recent studies connecting children's anticipation of moral emotion (or lack thereof) to both prosocial behavior (e.g., Gummerum, Hanoch, Keller, Parsons, & Hummel, 2010), and antisocial behavior (e.g., Krettenauer & Eichler, 2006). The four papers presented here represent fresh efforts to clarify what is known about children's understanding and experience of sociomoral emotions.

The first presenters examined the emotions that children associate with both resisting and committing transgressions across three types of social events: moral, conventional, and prudential. The happy victimizer pattern of attribution was absent. Instead, children associated positive emotion with resisting transgressions and negative emotion with committing transgressions. Increasingly mature justifications for emotion attributions were associated with advances in theory of mind. The second author explored children's predictions regarding the links between thoughts that occur before behavior – thoughts about current desires, future outcomes, and established rules – and subsequent emotions. Children associated resisting transgression with positive emotion when thoughts about rules or future outcomes were made salient. The third set of authors did the important work of exploring links between children's observable behavior and their thinking about sociomoral emotions. They found that generosity with an unfamiliar peer in a sharing paradigm was predicted by children's anticipation of post-transgression guilt. The

fourth author used a series of sharing paradigms to measure and compare children's predicted emotions, children's experienced emotions, and emotions children attributed to an agemate. Young children attributed good feelings to themselves and their peers following observable unfair behavior, but often failed to anticipate these "happy victimizer" emotions in themselves. Such findings are consistent with affective forecasting research (e.g., Gilbert et al., 1998) which shows that people find unexpected ways to feel good about negative events, such as behaving unfairly.

Domain distinctions in children's sociomoral emotion attributions: age and ToM-related influences

William Arsenio (Yeshiva University)
Nadine Fitoussi (Yeshiva University)

Doing what I want versus what I should: Children's reasoning about decisions and emotions in rule situations

Kristin Hansen Lagattuta (University of California, Davis)

Bridging the thought-action gap: The relation between children's moral emotion attributions and sharing with others

Bryan W Sokol (Saint Louis University)
Megan McCall (Saint Louis University)

Children's emotion attributions to self and other following generous and selfish behavior

Craig E Smith (Harvard University)

9:00-10:30 SY27 Symposium Session 27 ..... Amador

Piaget's essential (and under-theorized) contribution to a democratic pedagogical theory

Organizer: Susan Jean Mayer (Brandeis University)

The deepest implications of Piaget's work for democratic pedagogical theory have little to do with the stage theory for which he is most well-known among North American educators. Rather, Piaget's seminal contribution to the notion of a distinctively democratic pedagogical practice lies in his profoundly original and penetrating methodological sensibility. Piaget's painstaking investigation of the barriers to a theoretically significant program of developmental research eventually led to his discovery of what remains the only reliable means of accessing and engaging the foreign perceptions, assumptions, and logics of children (Bond & Tryphon, 2009). The methodological commitments that underpinned Piaget's efforts emerged from the dynamic context of early 20th century European psychological thought and so were rooted within the defining Western philosophical commitments and questions that had originally generated the field of developmental psychology (identifying reference, 2005; Inhelder, 1957).

Piaget's methodological insights and means have since informed countless educational interventions of note – from the renowned tradition of the Reggio Emilia schools in Italy, to the development of early North American investigatory curricula such as the Elementary Science Study and African Primary Science Program in the 1960s, to the current pedagogical interventions of Israeli psychologist Reuven Feurerstein, who primarily theorizes his work in socio-cultural terms, but whose methods owe a considerable debt to his studies with Piaget in Geneva. Such passing (or missing) references to Piagetian theoretical influences have become common today, in large part due to the inadequate theorizing of Piagetian methodology within the North American psychological tradition, which remains limited by its founding associationist and behaviorist influences.

The papers in this panel all explore this under-theorized movement of Piagetian methodology into contemporary pedagogical contexts. Democratic educators, in particular, cannot afford to lose sight of the essential contribution Piagetian method has made to operationalizing a sensitive attention – and principled deference – toward the meanings and meaning-making of children. Nor, certainly, can they afford to lose sight of the democratic commitments that justify such attention. Rather, Piagetian approaches and insights must assume a well-earned place alongside socio-cultural contributions within a comprehensively theorized democratic pedagogical sensibility (identifying reference, 2009). As Piagetian scholars and educators such as Eleanor Duckworth have demonstrated (Duckworth, 1996; 2001), a Piagetian approach to appreciating the divergent understandings of others can work in a deeply democratic manner to upend traditional intellectual hierarchies within classrooms, allowing the creativity and intelligence of all to be revealed and fostered.

Reconsidering Piaget's pedagogical ideas in light of the "preschool in three cultures" studies
Yeh Hsueh (University of Memphis)

Piaget in action: critical exploration in the university classroom
Sabine Hoidn (Harvard University)

Critical exploration and the challenging trust
William Shorr (Wheelock College)

Piaget and the process of knowing
Susan Jean Mayer (Brandeis University)

9:00-10:30 PS19 Paper Session 19..... El Dorado

Moral & Social Development II

Chair: Carolyn Hildebrandt (University of Northern Iowa)

Implications of using disclaimers to influence future performance expectations and character evaluations: Is there a trade off?
Dawn Watling (University of London)

Disclaimers – self-presentational tactic used prior to anticipated negative behavior to minimize the effect the subsequent behavior will have on how others view the self – have typically been found to be understood by 11-year-olds. Work to date has focused on ability evaluations and fails to divulge the protagonist's actual performance. In study 1 differences in 8- to 12-year-olds (N = 132) judgments depending on if a disclaimer was offered or not for the anticipated performance (e.g., in a race) or for a personality characteristic (e.g., laziness), and in study 2 differences with a second group of 8- to 14-year-olds (N = 185) performance judgments after hearing how the protagonist actually performed on the day. Results demonstrate that children consider contextual information in their understanding of disclaimers. Disclaimers were effective for typical performance evaluations (higher judgments than when no disclaimer offered), but not for typical personality evaluation, and they were less when offered prior to a positive than negative performance. Furthermore, when a disclaimer was offered prior to a negative behavior (personality related) or when actual performance was positive, children character judgments were more negative than when no disclaimer was offered. Results are discussed with regards to implications for children's social relationships.

The effects of moral framing on eyewitness identification: A developmental perspective

Toni Spring (Queens College, CUNY)
Herbert D Saltzstein (The Graduate Center, CUNY)

Children 7-9, 10-12, adolescents [13-15] and adults witnessed a brief film. In one condition, the voice-over described the perpetrator's intention was to start a fire, but none actually occurred [bad intention] whereas in the other condition, the perpetrator unintentionally started a serious fire [bad outcome]. Judgments of the perpetrator and foils were analyzed by signal detection. Ten-12 years olds used a looser criterion, more false positives, in the bad outcome than bad intention fire; 7-9 year olds used a looser criterion in both conditions and the adolescents and adults, a stricter criterion [fewer false positives] in both conditions. When the participants were asked, which error was worse, the choice shifted from false negatives to false positives as age increased. However, all age groups explicitly judged the bad intention act as worse.

Creating culture in children's group to scaffold identity development

Denise Goldbeck (Kids in the Spotlight)
Gwen B Fischer (Hiram College)

Recognizing the importance of culture regarding the development of identity, a replicable program has been created which provides a supportive social structure, thereby scaffolding children to explore their identities in an atmosphere of mutual respect. The art of scaffolding is directly taught to children such that 5 year olds scaffold 7 year olds, etc. Kids in the Spotlight (KITS) (www.kidsinthespotlight.ca) is in its 24th year at Haven (www.haven.ca) on Gabriola Island, B.C., Canada. 40-50 children ranging in age from 3 to 18 years old, along with a young adult and one elder, collaborate together for 5 days to produce a pantomime musical production to an audience of 60 people. The range in ages becomes the matrix within which to teach the children about their own development and mutual respect. Younger children can look ahead along the developmental spectrum, graphically presented in the flesh, whereas older children get a sense of how far they have come. Identity development is supported through the traditions of the group which provide recognition and foster exploration, commitment and ultimately identity achievement. The organizational structure and functioning of KITS follow developmental principles supported by the research of Kegan, Chandler, Kohlberg, Erikson,Marcia, Vygotsky and Piaget.

Socializing morality in the classroom

Lynda Stone (California State University)
Madeleine Robillard (California State University)

This video ethnography investigates how the practical-moral knowledge or the shared purposes, values, and norms for the "correct" way to construct literacy knowledge influences how students engage in regulatory processes. Twenty literacy lessons were collected from two upper elementary classrooms located in a low-income urban neighborhood in northern California. Discourse and conversation analysis were used to build analytic accounts of how teachers marked the purpose and methods of constructing literacy knowledge as important and valued ways of engaging in learning. These analytic accounts, which captured the practical-moral knowledge of a classroom, were used to examine instances of regulatory processes used by students. Findings pointed to two general patterns. When instructional practices marked efficiency and accuracy in using a text for solutions then students tended to toggled between other-or teacher-regulation and self-regulation with few occurrences of collaborative or co-regulation. In contrast, when instructional practices marked negotiation of knowledge and understanding as the purposes of literacy learning, then students exhibited fluid movement between self-, co-, and other regulation in the service of knowledge production.

Adolescents' and young adults' moral reasoning about cyberbullying

Carolyn Hildebrandt (University of Northern Iowa)
Katelyn Rohlf (University of Northern Iowa)
Jessica Anthony (University of Northern Iowa)
Indrani Thiruselvam (University of Northern Iowa)

Two studies investigating adolescents' and young adults' knowledge, experience, and moral judgments about cyberbullying will be presented. In Study 1, 191 college students (a) responded to questions about the prevalence of cyberbullying in their lives and the roles they played in it, and (b) read a series of hypothetical scenarios involving cyberbullying and made moral judgments about them. Results showed that 34% of students were victims, 19% were violators, and 64% were observers in cyberbullying incidents. Females were more likely to be victims and males were more likely to be violators and observers. In the scenario where the intention of the violator was to harm the victim and the victim was seriously harmed, 97.5% thought the act was wrong for moral reasons. In the scenario where the intentions and consequences were ambiguous, 60.9% of the students thought the act was alright and invoked "freedom of speech" to justify their answers. In Study 2, junior high, high school, and college students responded to revised versions of (a) and (b) and then filled out a questionnaire about their knowledge of privacy settings on social networking sites. Results of both studies will be reported along with suggestions for cyberbullying education and prevention programs.

9:00-10:30 PS20 Paper Session 20.....Mariposa

Language & Math Education

Chair: Terezinha Nunes (University of Oxford)

The advantage of a contrasted introduction of similar concepts in algebra

Esther Ziegler (ETH Zurich)
Elsbeth Stern (ETH Zurich)

Numerous studies have shown the positive effect of comparisons on concept learning. Previous studies used comparing examples with dissimilar surfaces to abstract a principle that subsequently can be applied to solve a novel problem. However, to understand closely-related concepts, it may be helpful to compare objects with similar surfaces to make differences more salient, in the sense of a contrasting. We examined whether comparisons used as contrasts can help to distinguish superficially similar concepts. A training study was conducted with a self-learning program for the introduction of two mathematical concepts: addition and multiplication in algebra. A total of 157 sixth-graders (mean-age= 12.4) were randomly assigned to two conditions: in the contrast condition they were presented addition and multiplication tasks simultaneously with the instructions to compare them, in the sequential condition they practiced addition examples for two days, followed by two days of multiplication training. In accordance with our hypotheses, all three posttests (one-day, one-week, ten-weeks-later) showed an advantage of contrasted learning compared to sequenced learning, although contrast learners performed worse in the immediate learning tests. This study demonstrated that contrasting is a promising learning method to differentiate superficially similar, although such learning leads to more errors in the training phase.

Stories, math, and patterns: Examining the relation between narrative and pattern abstraction in preschoolers

Dana Liebermann Finestone (University of Waterloo)
Daniela O'Neill (University of Waterloo)
Clarissa Gee Yun Leung (University of Waterloo)

Devlin (2002), a mathematician, suggests that mathematical reasoning can be differentiated from arithmetic ability, with the former including skills such as handling abstraction. Devlin posits that mathematical reasoning skills rely, in part, on our earlier linguistic abilities that include the ability to follow and tell a story. As story comprehension and patterning skills are often emphasized in preschool and early elementary curricula, the studies presented in this talk focused on examining the relation between three narrative abilities and the higher-order mathematical reasoning skill of pattern abstraction. In Study 1, 5-year-olds' performance on a narrative theme identification task, but not a narrative sequencing task, was related to performance on pattern abstraction task assessing children's ability to abstract out a pattern from a series of objects. Study 2 confirmed the findings of Study 1, with a stronger significant correlation found between 5-year-olds' performance on the narrative theme and pattern abstraction tasks. In addition, a significant relation existed between children's perspective shifting abilities and performance on the pattern abstraction task. Our results underscore the fact that narrative ability is not a unitary construct and highlight the need to carefully consider specific narrative abilities in order to better understand their potential relation to other specific higher-order abilities such as mathematical reasoning.

Simple language versus relevant situations: English language learner's retelling of mathematics story problems

Rebecca Ambrose (University of California-Davis)
Marta Molina (University of Granada)

In collecting data to explore the relationship between language and mathematics for bilingual six-year old children, we found that they faced unanticipated difficulties retelling what we thought was a straightforward division story problem. We analyzed children's retelling of the division problems in English and Spanish along with their solution strategies, compared to work on addition and subtraction problems in both languages. The data indicated children left out elements, especially the questions, in retelling all problems in both languages. The division problem contexts led children to miscomprehend those problems, which was not the case for the addition and subtraction problems. We conclude by noting the tension between keeping problem statements simple and contextual features realistic for English Language Learners.

Different strategies for solving mathematical equivalence in a sign language

Aaron Shield (University of Chicago)
Melissa Herzig (University of California, San Diego)
Carol Padden (University of California, San Diego)
Susan Goldin-Meadow (University of Chicago)

This paper investigates two different linguistic strategies used by signing deaf children while solving mathematical equivalence problems. We tested 30 deaf children of deaf parents between the ages of 9 and 12 on mathematical equivalence problems. After a written pre-test, children were asked to explain how they arrived at their answers. Children were then trained on the concept of equivalence and re-tested. We observed two major explanation strategies. The first is a spatial strategy, in which children take advantage of the signing space in explaining their answers. The second is a lexical strategy, in which the problem is expressed linearly, similar to speech. We hypothesize that the spatial strategy facilitates learning and we predict that learners who use this strategy will perform better on the post-test than learners who use the lexical strategy. If we find that children who use the spatial strategy perform better, we will have evidence that overtly spatial strategies aid deaf children when doing math problems.

Mathematical reasoning and cultural languages in the Philippines

Craig N Refugio (Jose Rizal Memorial State University)

This research paper investigated the relationship between mathematical reasoning and cultural languages in the Philippines. A case study was conducted on how high school students in the Philippines reason out mathematically using their respective cultural languages like Tagalog, Cebuano and Subano in comparison to the English Language which is the official medium of instruction in the Philippines in all grade levels from kindergarten to graduate studies. The study revealed that high school students in the Philippines specifically in Mutia, Zamboanga del Norte did good in mathematical reasoning using their respective cultural languages rather than using the English language medium.

Equipartitioning as a Basis for Rational Number

Jere Confrey (North Carolina State University)
Alan Maloney (North Carolina State University)
Kenny Nguyen (North Carolina State University)

Equipartitioning refers to fair sharing of quantities (collections and wholes) among multiple people. Prior to our synthesis work, research on equipartitioning collections, single wholes and multiple wholes resided separately in the literature. By examining the corpus of studies, Confrey et al. were able to identify a learning trajectory that established deep understanding of equipartitioning over time. This learning trajectory was represented in the form of a matrix that distinguishes a sequence of proficiency levels and a set of task classes. Based on the LT and related matrix, we constructed a set of 125 assessment items, field-tested them with over 5000 students, grades K-8 and validated the trajectory using IRT analysis. In this paper, we compare and contrast our results from the set of 40 clinical interviews and the IRT analysis. We discuss how validation of the trajectory can be viewed as the integration of results from these two sources of validation.

10:30-10:45 break

10:45-12:00 PL05 Plenary Session 5 ..... Ballroom

The universal and the particular in scientific reasoning

Deanna Kuhn (Columbia University)

There is much to learn from cultural studies, with the enormous varieties of human experience that they reveal. But most fundamentally, we study culture to understand what is universal about human experience. In the domain of scientific reasoning, Kuhn shares what she has learned in taking her studies from the laboratory to the classroom and, in particular, insights gained with respect to generalities and specificities in the development of scientific thinking, from a practical as well as a theoretical perspective.

12:00-1:15 Lunch (Board of Directors Meeting – Quarter Deck)

1:15-2:45 SY28 Symposium Session 28 ..... Belvedere

Models, modeling, and naïve intuitive knowledge in science learning

Organizer: Pratim Sengupta (Vanderbilt University)
Discussant: Rogers Hall (Vanderbilt University)

Models and modeling are defining characteristics of science (Giere, 1988; Nercessian, 2008). The design of models for pedagogical use in classrooms, as well as the development of students' modeling knowledge and practices, are now central agendas in science education research (Clark, Nelson, Sengupta & D'Angelo, 2009; Lehrer & Schauble, 2008). This symposium seeks to address the following question: what is the relationship between students' intuitive knowledge and the design of models and modeling-based learning environments to support the reorganization of that intuitive knowledge? Papers 1 and 2 investigate the nature and role of intuitive knowledge that elementary students draw upon as they are scaffolded in scientific reasoning about complex ecological phenomena (soil decomposition and natural selection). The context of students' inquiry in Paper 1 is a computational learning environment based on a multi-agent-based model focusing on the aggregate- or population-level behaviors (e.g., population dynamics of different species in a predator-prey ecosystem) that arise from simple rule-based interactions between thousands of individual-level agents (e.g., birds eat butterflies; butterflies drink nectar; etc.). The context of inquiry in Paper 2 is a non-computational, year-long modeling and explanation unit focusing on soil decomposition. Paper 3 focuses on how a game-based learning environment can be designed to foster model-based thinking in physics by bridging students' intuitive ideas about kinematics with disciplinary representations and concepts.

The studies reported here belong to the genre of design-based research studies. Each study focuses on identifying the nature of student thinking and the process of development of student reasoning, as well as the conditions under which this development occurs. While traditional approaches to science education have frequently emphasized students' misconceptions and what they cannot do or learn (c.f. Metz, 1995; Lehrer & Schauble, 2006), this symposium frames intuitive knowledge in a more productive perspective. More specifically, this symposium focuses on the nature of intuitive knowledge (relevant to the phenomenon being investigated) that novices bring with them to the classroom and how this initial knowledge can be bootstrapped through cultural supports and practices to develop more sophisticated understandings of scientific phenomena. Finally, the research reported here is research conducted in contexts of designing cultural supports for developing scientific reasoning — in that regard, it directly speaks to the theme of the 2011 JPS conference.

Learning natural selection in 4th grade with multi-agent-based computational models
Amanda Catherine Dickes (Vanderbilt University)
Pratim Sengupta (Vanderbilt University)

An investigation of the development of elementary students' reasoning about the process of soil decomposition
Isi Ero Tolliver (Vanderbilt University)
Pratim Sengupta (Vanderbilt University)
Deborah Lucas (Vanderbilt University)

Building connections between students' intuitive ideas and formal concepts in physics through scaffolding in conceptually-integrated digital games

Douglas Clark (Vanderbilt University)
Brian Nelson (Arizona State University)
Mario Martinez-Garza (Vanderbilt University)
Kent Slack (Arizona State University)
Daniel Garvey (Arizona State University)

1:15-2:45 SY29 Symposium Session 29 ..... Yerba Buena

Parental supports in informal learning environments: Developing children's scientific concepts and skills

Organizer: Lynn S Liben (The Pennsylvania State University)
Discussant: Maureen A Callanan (University of California, Santa Cruz)

Encouraging interest in science has been of increasing concern to those who monitor the adequacy of the Science, Technology, Engineering, and Mathematics (STEM) workforce in the United States (NSF Science and Engineering Indicators, 2006). The most visible pathway for facilitating students' scientific and mathematical achievements is formal education, but there is growing recognition that out-of-school, informal learning experiences are also important for enhancing children's early interest, skills, and understanding of science (National Research Council, 1996). Research has shown that parent-child conversations contribute to children's developing theories of how the world works (Callanan & Oakes, 1992), and to their use of evidence generation and interpretation in problem solving (Gleason & Schauble, 2002). This symposium covers several diverse projects, each examining some aspect of informal parent-child interactions that support foundational science skills, and each considering ways that interactions differ in relation to gender and/or ethnicity. The first presentation (Liben, Tamis-LeMonda, Ng, Borriello, & Kuchirko) reports data drawn from a larger longitudinal study of parenting in U.S. families of Chinese, Mexican, Dominican, or African American descent. Here we report on behaviors that appear to support the development of spatial thinking in 4-year-olds as mothers and children play collaboratively with building blocks. Findings show different patterns of spatial engagement in relation to both ethnicity and gender. The second presentation (Myers, Liben, & Scholom) studies parents and children (K-Grade 6) at a museum exhibit in which visitors first create and then map a model town. Conversations were found to differ in relation to gender and related to parents' and children's performance on select cognitive measures. The third presentation (Carey & Szechter) studies conversations between parents and their children (8 – 16 years) at an informal science education center housed in an active gravitational-wave observatory. When dyads visited the exhibit hall after (rather than before) engaging in an inquiry activity, their conversations involved a greater number of questions, more descriptions of evidence, and greater use of scientific terms. The discussant (Callanan) will integrate and extend the presentations by drawing on her extensive research on how children's theories about the world are influenced by interactions with their parents in informal contexts. Taken together, the symposium presentations demonstrate that parent-child interactions in informal contexts may provide an important context for developing scientific skills and concepts.

Early contexts for learning to think spatially: Qualities of mother-child block play

Lynn S Liben (The Pennsylvania State University)
Catherine S Tamis-LeMonda (New York University)
Florrie Fei-Yin Ng (The Chinese University of Hong Kong)
Giulia A Borriello (The Pennsylvania State University)
Yana Kuchirko (New York University)

"If this is our house, which way is North?" Parent-child museum conversations about spatial and symbolic qualities of maps

Lauren J Myers (Bryn Mawr College)
Lynn S Liben (The Pennsylvania State University)
Elizabeth Scholom (Haverford College)

Children's engagement in a science exhibit: The role of parents and inquiry experiences

Elizabeth J Carey (Tulane University)
Lisa E Szechter (Tulane University)

1:15-2:45 SY30 Symposium Session 30..... Treasure

Good intentions, problematic epistemologies: Why common "supports" for science students hinder inquiry

Organizer: Andrew Elby (University of Maryland)
Discussant: Michael Ford (University of Pittsburgh)

In U.S. K-12 schooling, "supports" have evolved for helping science students succeed. They include (1) frontloading vocabulary, especially for English language learners (ELLs), to scaffold discussions; (2) a step-by-step scientific method to guide inquiry; and (3) state-level standardized science testing to enhance accountability. We argue that these "supports" are actually hindrances to engaging students in scientific inquiry. Critiques of these "supports" are not new, of course. What we add is an argument that a common mechanism helps to account for the harmfulness of all three "supports." These "supports" tend to trigger epistemological stances in which teachers and students view learning and doing science as only loosely connected to sense-making.

Our three posters, corresponding to the three "supports," each present a case study of what happens in a K-12 classroom when the "support" suddenly becomes less salient or more salient. Attendees will interact with the poster presenters for most of the session. Discussant Michael Ford will then offer commentary and lead a discussion.

Poster 1: Deemphasizing science vocabulary with English language learners. We use two videotaped classroom episodes to argue that deemphasizing and backloading vocabulary can help ELLs epistemologically (re)frame their activity as making sense of ideas, seeking vocabulary when they need it to express their ideas.

Poster 2: How the scientific method derails authentic inquiry. Critiques of the "scientific method" have generally focused on the inauthenticity of discrete steps as a representation of scientific practice. Our critique focuses instead on the unproductive epistemological stances that the "scientific method" tends to trigger. In the small-group discussion we analyzed, students engaged in inquiry except when the scientific method popped into their discussion.

Poster 3: "We can't really talk about the whys of magnetism now." We discuss how a student's question during a magnetism unit, "Do magnets work under water?" was deferred until after the state assessment. After the assessment, the teacher came back to the question, which then formed the basis for a seven-day emergent unit that centered on students' arguments and the experiments they designed to answer their own questions. We argue that this extended inquiry was able to happen only because the teacher felt freed from the usual curricular "supports;" the teacher and students came to share a framing of their activity as investigating students' ideas.

Deemphasizing science vocabulary with English language learners
Luke Conlin (University of Maryland)
Kweli Powell (University of Maryland)

How the scientific method derails authentic inquiry
Xiaowei Tang (University of Maryland)

"We can't really talk about the whys of magnetism now"
Colleen Gillespie (University of Maryland)

1:15-2:45 SY31 Symposium Session 31 ..... Angel

Putting Piagetian theory back into children's mathematical reasoning

Organizer: Kevin Muldoon (Heriot Watt University)
Organizer: Charlie Lewis (Lancaster University)
Discussant: Stéphan Desrochers (Université Laval)

Two distinct approaches to children's number knowledge have co-existed in developmental psychology for some time. On the one hand, Piagetian theory focuses on children's reasoning about quantities and places less emphasis on numerical representations, consistently with the view that children construct mathematical reasoning from their schemas of action. On the other hand, Gelman and others focus on learning to count and attributing meaning to number words; operating on quantities is seen as a later problem of applying number knowledge to solve problems. In this symposium we re-examine the Piagetian contribution to early mathematics, examining cardinality, simple number tasks and multiplication.

Paper 1 considers the critique that Piaget's theory focuses only on logic and largely denies the impact of social mediation on number learning. Both objections are unwarranted. It presents findings from two studies that highlight the importance of interaction between social, linguistic and logico-mathematical influences on grasping the relationship between within-set counting and between-set comparison. It concludes that it is necessary to reconsider how a model of early number development must account for "the victory of operation over intuition".

Paper 2 considers how children use numbers to perform simple arithmetic tasks. It takes the discussion about set comparison and cardinality further, reflecting on the current focus on single sets. It reports a comparison between the use of the number line and of concrete materials as tools to help 6/7 year old children to solve addition and subtraction problems. Children using concrete materials were much more successful, employing better problem-solving strategies than those in the number line group. The number line, as used in schools, may not help children to understand the relations between quantities in problems, but may be a good tool for teaching children how to add and subtract.

Paper 3 models how children develop multiplication strategies examining Siegler's 'overlapping waves' metaphor. In a microgenetic study of in-depth changes in strategy use and accuracy over eight week sessions, 96 second grade children performed 15 single-digit multiplication problems. Analysis using a categorical growth model led to the idea of strategy development resulting in a dynamic 'overlapping waves' model for development that might perhaps be generalized into a testable and dynamic version of a stage model for Piagetian tasks.

The Discussant is well-placed to reflect upon the perspectives and data presented. He has worked on substantive Piagetian problems including number.

How young children learn to reason correctly about set equivalence
Kevin Muldoon (Heriot Watt University)
Charlie Lewis (Lancaster University)

Learning to think with numbers
Terezinha Nunes (University of Oxford)
Peter Bryant (University of Oxford)
Deborah Evans (University of Oxford)
Daniel Bell (University of Oxford)

Using statistical modeling to model strategy change in multiplication
Jan Boom (Utrecht University)
Sanne H G van der Ven (Utrecht University)

1:15-2:45 SY32 Symposium Session 32.....Amador

How children learn to think scientifically

Organizer: Paul van Geert (University of Groningen)
Organizer: Henderien Steenbeek (University of Groningen)
Discussant: Todd Rose (Center for Applied Special Technology)

This symposium focuses on the emergence of scientific thinking in children and the role of school education in this process, by presenting three studies from a major research project in the Netherlands, Curious Minds. This program aims at promoting young children's natural curiosity for exploring the world around them and typically provides children with science related activities and challenges them to explore and discover phenomena while relying on skills such as problem solving and logical reasoning (Talentenkracht, 2010).

Thinking scientifically entails a complex process, kindled by curiosity, based on the person's available (or absent) mental models or beliefs. Curiosity leads to exploratory actions. Such actions, which are absorbing and often of strong emotional valence, lead to changes in one's beliefs and mental models. On the other hand, thinking scientifically is also a deeply socially embedded process, requiring clear communication of mental models, expectations and findings to others and serious comparison to what others have found and thought. Many of these processes find their roots in the daily experience of children. Scholarly education must contribute to bringing these processes and skills together into genuine scientific thinking, as adults can greatly contribute to the development of children's natural scientific talents in terms of structuring information, fostering curiosity and providing encouragement (National Research Council, 2007).

Presentation 1 of this symposium discusses the development of children's mental models of fetal development, a process to which children have no direct experiential access. Presentation 2 presents detailed process studies of young children's thinking in various scientific problem domains, based on a model of dynamic interrelations between the child's activity, the adult's activity and the affordances of the materials. Presentation 3 discusses how teachers help children to think scientifically by providing them with useful scientific verbal terms, and how teachers can be taught to do so effectively. Dr. L.T. Rose (Harvard Graduate School of Education) will discuss the three contributions from the perspective of how to foster the development of scientific thinking in young children.

Mental models of fetal development
M E J Raijmakers (University of Amsterdam)

A dynamic approach to scientific talent
H Meindertsma (University of Groningen)
S van der Steen (University of Groningen)
H W Steenbeek (University of Groningen)
M W G van Dijk (University of Groningen)
P L C van Geert (University of Groningen)

Promoting academic language during science lessons in kindergarten: an intervention study
L F Henrichs (University of Utrecht)
P P M Leseman (University of Utrecht)
K Broekhof (Sardes Utrecht, NL)
H Cohen De Lara (University of Utrecht)

1:15-2:45 PS21 Paper Session 21 ..... El Dorado

Math Development

Chair: Emily Slusser (Wesleyan University)

The role of non-verbal numerical representations in the acquisition of early number word meanings
Emily Slusser (Wesleyan University)
Anna Shusterman (Wesleyan University)
Justin Halberda (Johns Hopkins University)
Darko Odic (Johns Hopkins University)

While the ability to represent approximate numerical magnitude (via the Approximate Number System (ANS)) is evolutionarily robust, the ability to use symbolic formats to represent and reason about numerical quantity is uniquely human – largely attributable to the support of language and culture. Although emergent evidence connecting these two systems is clear, the mechanisms by which a symbolic, language-based number system becomes integrated with the approximate, non-symbolic representations has yet to be determined. The present study investigates ANS ties to the earliest assessments of verbal number knowledge, namely the acquisition of individual number-word meanings. Forty-six 3- and 4-year-old children participated in a longitudinal study evaluating ANS acuity and verbal number word knowledge. Results show that ANS acuity is more strongly linked to verbal number knowledge than age. Additionally, we see that ANS acuity undergoes a sharp increase when jumps in verbal number knowledge occur. The greatest increase in ANS acuity, however, occurs during the subsequent interval, suggesting that increases in verbal number knowledge precede, and possibly initiate, increases in ANS acuity. These findings strongly implicate the ANS in children's earliest entry into knowledge of symbolic number and suggest that experience with culture and language may changes properties of a core cognitive system.

The hard journey to counting proficiency: A study with children from 5 to 8 year-olds
Ana Escudero Montero (Universidad Complutense de Madrid)
Purificación Rodríguez Marcos (Universidad Complutense de Madrid)
Mª Oliva Lago Marcos (Universidad Complutense de Madrid)
Cristina Dopico Crespo (Universidad Complutense de Madrid)
Ileana Enesco Arana (Universidad Complutense de Madrid)
Silvia Guerrero Moreno (Universidad Castilla-La Mancha)

Counting skill is a very complex cognitive process that involves the mastery of the five counting principles described by Gelman and Gallistel (1978) (i.e., one-to-one correspondence, stable order, cardinality, abstraction, and irrelevance of order). Although some previous studies have shown that its acquisition is still incomplete at the end of preschool years, there are really few authors who have dealt with the development of the counting skill during the primary school years so far. In this work, we want to analyze the understanding that children between 5 and 8 years old have about the counting principles by using the error detection task. Seventy four children judged the correctness of several counting trials. Two specific errors and two specific pseudo-errors, besides a correct counting trial, were presented for each of the five principles by means of a computer program created ad hoc for this research. Our results showed that children's performance, regardless age group, was better in errors than in pseudo-errors trials. Furthermore, the probability that children accepted the pseudo-errors as correct increased both 1) in older children and 2) in the trials in which the role of counting was made explicit by stating the cardinal value of the set.

The effect of culturally specific instructional practices on learning about mathematical equivalence

Rebecca Watchorn (University of Alberta)
Jillian Avis (University of Alberta)
Jeffrey Bisanz (University of Alberta)

An important hurdle in the development of mathematical skill is mastering algebra, a gatekeeper to higher math. Understanding symbols such as the equal sign is essential for solving basic algebraic equations. The majority of American and Canadian children, however, interpret the equal sign as meaning, "put the total next" instead of expressing the equality between both sides of the equation. Performance on equivalence problems (e.g., 2 + 4 = 3 + __) reflects this misunderstanding. In Study 1, we found that Taiwanese children were far more likely than Canadian children to solve equivalence problems correctly, indicating that poor performance on these problems is not a universal pattern in mathematical learning. One hypothesis is that performance on equivalence problems is greatly facilitated by exposure to "non-canonical" arithmetic problems (e.g., 2 + 4 = 1 + 5). In Study 2, we found each of four Taiwanese and none of the Canadian math texts included non-canonical arithmetic problems. In Study 3, Canadian students in Grades 1 and 2 who were exposed to non-canonical problems in five monthly instructional sessions outperformed their peers on equivalence problems. These results imply that exposure to non-canonical problems may be important for understanding the equal sign.

Number-line estimation tasks reflect reasoning about proportionality and numerical magnitude

Emily Slusser (Wesleyan University)
Jennifer Garcia (Wesleyan University)
Kyle MacDonald (Stanford University)
Anima Acheampong (Wesleyan University)
Shipra Kanjlia (Wesleyan University)
Rachel Santiago (Wesleyan University)
Hilary Barth (Wesleyan University)

Recent findings suggest that number-line estimation tasks elicit reasoning regarding relative quantity or proportionality, rather than unbounded numerical magnitude (Barth & Paladino, 2010). To investigate how predictions of psychophysical proportion-judgment models (see Hollands & Dyre, 2000) map onto performance across age and experience the present study tested 5- to 10-year-old children on number-line tasks presenting both familiar and unfamiliar numerical contexts. Results show that, when compared to logarithmic and linear models, the proportion judgment model provides better explanations for

estimation patterns of most age groups on both numerical ranges. More specifically, we see that estimation patterns progress from one- to two-cycle models, suggesting that children first learn to exploit given endpoints and later learn to infer midpoints. While two-cycle proportion judgment models generally offer the best fit for performance of older age groups, mental representations of numerical magnitude become noticeably less-biased with age. Given the well established links between performance on number-line estimation tasks and grade-school mathematics, the notion that proportion-judgment models explicate patterns in estimation biases as well as improvements made with age and experience has important implications for theories about numerical reasoning as well as educational practices.

Development of proportional reasoning: A reaction time study

Ruth Stavy (Tel Aviv University)
Reuven Babai (Tel Aviv University)

Children experience difficulty with proportionality. Here, 244 participants (grades 1, 3, 5, 8-9 & adults) compared the intensities of color of two mixtures of red and white paint-drops. Accuracy and reaction times were recorded. There were two trial conditions: a) Congruent, in line with intuition 1 larger number of red drops–darker; b) Incongruent, in line with intuition 2 larger number of white drops–lighter. Each included 3 trial-types which cued: 1) only one intuition; 2) one intuition more than the other; 3) both intuitions to the same extent. Type1 congruent trials accuracy gradually increased from 66% in grade1 to 96% in adults. Type1 incongruent trials accuracy was low in grade 1 (27%), and reached 94% in adults. Similar results were obtained in Type2 trials. A decrease in accuracy was observed in Type3 congruent trials from grades 1 to 5 (63% to 43%) that was followed by increase to 70% in adults. In Type3 incongruent trials accuracy was low in grades 1, 3, & 5 (below 20%) and 66% in adults. In-depth analysis of participants' accuracy of responses and reaction times allowed understanding the role of these two intuitions, their interactions and impact in the development of proportional reasoning.

1:15-2:45 PS22 Paper Session 22.....Mariposa

Reasoning, Computation, Femininity: An eclectic set

Chair: R B Church (Northeastern Illinois University)

Young men's vulnerability in relation to women's resistance to emphasized femininity

Neill Korobov (University of West Georgia)

This study uses a critical-gender and discursive approach to examine emerging adult men's (n = 36) vulnerabilities in relation to emphasized femininity. Since masculinity is inextricably defined in relation to femininity, men's achievement of masculinity is intimately dependent upon, and vulnerable to, women's complicity with traditional or emphasized femininity. Analyses centered on the romantic relationship stories that groups of emerging adult male friends told that involved their female partners resisting one of three forms of emphasized femininity: 1) compliance or receptivity to men's sexual advances and desires, 2) emotional caretaking, and 3) passivity. Rather than ratcheting up traditionally heroic and macho masculine responses, the young men managed vulnerability through self-deprecation, nonchalance, and dispositional scripting of the young women's personalities in order to construct an anti-heroic and ordinary masculinity. Insights into the sociocultural development of emerging adult men's vulnerability in relation to young women's experience of emphasized femininity are discussed with the aim of expanding theoretical models of 'men's pain', models that continue to pivot predominantly around hegemonic masculinity.

Why can simple computational techniques sometimes replicate the work of human coders?

Bruce Sherin (Northwestern University)

The freedom afforded by clinical interviews poses some unique challenges when we seek to analyze the data that these interviews provide. In this presentation, we report on our attempts to add new tools to the repertoire of analysts; in particular, we are exploring the use of automated, computational analyses of transcript data drawn from clinical interviews. To an extent we have found surprising, these computational techniques have been able to replicate more laborious analyses carried out by hand. More specifically, the focus of this presentation will be to attempt to explain how this is possible: How can relatively crude computational algorithms replicate some of the work of human coders, even when these algorithms are given less information than those coders? We believe that the mere fact that relatively simple computational techniques can replicate the work of human analysts says something important about the work of human analysts, and the larger endeavor in which we are engaged. Thus, the answer to this question has the potential to be broadly illuminating. In this work, we draw on a corpus of 54 clinical interviews in which middle school-aged students were asked questions about the Earth's climate and seasons.

Linking the dynamics of student reasoning to epistemology

Eric Kuo (University of Maryland)
Michael M Hull (University of Maryland)
Ayush Gupta (University of Maryland)

Although much research shows that students' conceptual and mathematical reasoning is dynamic and sensitive to context, few studies provide fine-grained accounts of the mechanisms driving those dynamics. We investigate one such mechanism in our case study of "Devon," an introductory physics student. In an interview, Devon is asked three questions with identical mathematical structure but differing subject and context. First, asked a physics problem about two rocks accelerating while falling, Devon was too unsure of himself to attempt a solution. But when asked a math word problem about money, Devon easily solved it by integrating mathematics with informal conceptual reasoning. Finally, posed a physics problem about two cars accelerating, Devon produced the same conceptual solution as for the money problem. We argue that Devon's conceptual reasoning during the cars problem is facilitated by the epistemological stance he adopted during the money problems, viewing equations as having conceptual meaning. We model part of Devon's reasoning with "symbolic forms," cognitive structures that blend conceptual schemas with symbol templates, and we present a fine-grained model in which the activation of these cognitive resources is dynamically linked to the activation of Devon's epistemological resources for viewing equations as conceptually meaningful vs. mere problem-solving tools.

Can visual arts learning improve geometric reasoning?

Lynn T Goldsmith (Education Development Center, Inc.)
Ellen Winner (Boston College)
Lois Hetland (Massachusetts College of Art and Design)
Craig Hoyle (Education Development Center, Inc)

The ability to visualize what cannot be directly seen is considered a critical skill in mathematics and sciences. Developing students' visualization skills might therefore help to enlarge the segment of the K–12 population that will have access to, and succeed in, higher-level mathematics and science. This study investigates the hypothesis that intensive work in the visual arts can contribute to the development of geometric reasoning by comparing the performance of a treatment group (9th grade students studying visual arts 9 hours/week) with comparison group (9th grade students studying theater or squash 9 hours/week) at two points in time (beginning and end of 9th grade). Preliminary results show a geometry advantage

at pretest for students choosing to study visual arts. Further analyses in which art and control students are matched at pretest should allow us to test the hypothesis that visual arts training is causally implicated in geometry gains.

The effect of gesture on adult memory of a legal closing argument

Steve Jacobs (University of Chicago)
R B Church (Northeastern Illinois University)
Chris Bennett (University of Chicago)
Jayson Murray (University of Chicago)

While gesture has been shown to enrich the listener's comprehension and semantic memory of the information conveyed in speech (Kelly, Barr, Church & Lynch 1999), this work has been done on simple speech utterances; in this study, we looked at gesture's effect on a more complex narrative: a legal closing argument. We decided on a closing argument, as this is a final synopsis of the case; it is an attorney's last chance to try and influence the jury to favor their client. We used a population of undergraduates from a diverse public university for our participants. The 22 participants in the control group were shown a video closing argument with speech only, while the 23 in the experimental condition were shown a closing argument with speech plus gesture. On an overall measure of content remembered, the group that was shown an argument with gesture (70%) significantly outperformed the control group (59%). We believe that this has important implications for trial law, as lawyers who gesture have a significant advantage, over lawyers who don't, on how much of their closing argument is remembered.

2:45-3:00 break

3:00-4:30 IS05 Invited Symposium Session 5.....Belvedere

Supporting modeling, explanation, and argumentation in elementary and middle school classrooms

Organizer: Brian J Reiser (Northwestern University)

Scientific practice has been conceptualized in a variety of different ways. Different approaches to analysis and different approaches to instructional support take different slices through the various aspects that make up scientific practice. Three foci that have emerged are explanation-building, argumentation, and scientific modeling. Typically, explanation refers to the practice of developing claims and a chain of reasoning to provide an account for how or why something has occurred (Sandoval & Reiser, 2004; Southerland, Abrams, Cummins, & Anzelmo, 2001). Argumentation refers the practice of attempting to persuade peers and reach consensus about scientific claims, including explanatory accounts (Driver, Newton, & Osborne, 2000; Sampson & Clark, 2008). Modeling typically refers to the practice associated with constructing, testing and revising a model (abstracted representations that embody key features of the phenomenon) that can explain or predict multiple phenomena (Giere, 1992; Harrison & Treagust, 2000). Although these are often considered as individual practices, they clearly overlap in many ways. For example, teaching students to develop models requires an understanding of what it means to explain phenomena, and how explanations need to fit evidence. In developing explanations of specific phenomena and in developing scientific models to predict and explain classes of phenomena, evaluating ideas against evidence plays a critical role. Scientific argumentation foregrounds the need to persuade peers of claims through fit with accepted ideas and evidence, but this is a key component of developing explanations and models. Similarly the need for criteria to evaluate scientific ideas and discourse strategies to compare ideas and attempt to reach consensus pervades all these practices. Each of these analytical and instructional approaches may foreground a different aspect, but we argue that there are three underlying

core elements of practice that pervade knowledge-building practices in science – developing explanatory accounts, persuading peers through scientific argumentation, and developing general scientific models. In this symposium we will explore how these aspects of practice interrelate, and examine design efforts to support these aspects of practice across elementary and middle school classrooms. We will consider the empirical evidence emerging from the studies that help identify the successes in supporting scientific practices and the challenges that emerge.

A proposed framework for scientific practices
Brian J Reiser (Northwestern University)

Data modeling practice in classrooms
Rich Lehrer (Vanderbilt University)
Leona Schauble (Vanderbilt University)

The tension between sensemaking and persuasion in classroom practice
Leema Berland (University of Texas at Austin)

Engaging elementary learners in modeling

Lisa Kenyon (Wright State University)

3:00-4:30 SY33 Symposium Session 33 ..... Yerba Buena

Beyond false belief: Theory of Mind assessment and application among diverse ages and populations

Organizer: Elizabeth Woodburn Cavadel (Mathematica Policy Research)
Organizer: Douglas A Frye (University of Pennsylvania)

Theory of mind (ToM): one's ability to apply mental state (intentions, beliefs, emotions) knowledge to interpersonal interactions, is considered foundational to social competence (e.g., Hughes, 2004). Initially focused on false belief in children, empirical study of ToM has expanded to include other mental states, older children, adults, and individuals with psychopathology. Despite this, a lack of sample diversity, integration across studies, and divergent tasks and methods, have left unanswered questions regarding the existence of a unified ToM, the consequences of disruptions in ToM development, and the validity of traditionally employed assessments of ToM.

The four papers in this symposium each describe ToM in a different, yet understudied population, thereby confronting these important issues in ToM assessment. The first paper examines two low-income, ethnic minority preschool populations and results suggest delays, particularly in false belief performance, in the early development of mental state understanding as compared with previously studied middle class populations. The second paper extends ToM study into adolescence and demonstrates that gender may influence the role of ToM in adolescents' social interactions. The third paper examines ToM in an understudied adult population, investigating later developing ToM skills among methamphetamine drug users, addressing the applicability of models of social cognition among populations with neurocognitive deficits. The fourth paper places the first three papers in a broader context: providing a theoretical and empirical investigation of the validity of an advanced ToM.

Taken together, these papers highlight the variability in the conceptualization of ToM across ages and populations, and provide a forum for a much needed discussion of the implications of this variability for social cognition among understudied populations. To the extent that ToM may be a crucial component of social and interpersonal functioning among children and adults, these studies contribute important

information about how future research might assess, study, and intervene in ToM development among diverse populations.

Developmental patterns of false belief and Theory of Mind among low-income ethnic minority children

Elizabeth Woodburn Cavadel (Mathematica Policy Research)
Douglas A Frye (University of Pennsylvania)

Theory of Mind understanding and conversational patterns in early adolescence

Sandra Leanne Bosacki (Brock University)

Assessing the effects of methamphetamine abuse and HIV on adult Theory of Mind

Bruce D Homer (The Graduate Center, CUNY)
Perry N Halkitis (New York University)
Rob W Moeller (New York University)
Todd M Solomon (New York University)

Theoretical and empirical support for the validity of an advanced Theory of Mind

Elizabeth O Hayward (New York University)

3:00-4:30 SY34 Symposium Session 34.....Treasure

Brazilian children's views on space, time, property and school

Organizer: Vera Maria R Vasconcellos (Universidade do Estado do Rio de Janeiro)
Organizer: Tania Mara Sperb (Universidade Federal do Rio Grande do Sul)

Early childhood education is a global concern since studies have been consistently showing that the first years of life are fundamental for healthy development of humans across the life course. In Brazil, early childhood education has a long story, however its importance has been only recently acknowledged by the Brazilian Educational System. Research plays a significant role in the construction of what should be developed in school with young children. The current symposium proposal focuses on Brazilian childhood and presents a set of four studies. In the first study Eisenberg, Motta, Barros & Lima discuss 2 to 4 year old children's learning about their routine through an immersion in temporal concepts. In the second study Vasconcellos & Moreira look at how babies (10 to 20 months old) construct the notion of space in a child care Center through observations of how space is understood by the babies before and after the introduction of large toys (soft play furniture). Donato Oliva investigates the origins of the sense of property with 3 to 8 year old children. The children come from two public schools: a preschool and an elementary school in Rio de Janeiro. Sperb, Marques & Soares look into the early educational context in a school in the south of Brazil (Porto Alegre), where they analyze the concepts 5 year old children have about preschool.

Children learn their routine at daycare through a one-month long immersion in temporal concepts

Zena Eisenberg (Pontifícia Universidade Católica do Rio de Janeiro)
Nathalia da Motta Xavier (Pontifícia Universidade Católica do Rio de Janeiro)
Roseli da Silva Barros (Pontifícia Universidade Católica do Rio de Janeiro)
Renata Moreira Lima (Pontifícia Universidade Católica do Rio de Janeiro)

The construction of the notion of space in 10 - 20 month old babies
Vera Maria R Vasconcellos (Universidade do Estado do Rio de Janeiro)
Ana Rosa Picanço Moreira (Universidade Estado do Rio de Janeiro)

Children's conceptions about the preschool
Tania Mara Sperb (Universidade Federal do Rio Grande do Sul)
Fernanda Martins Marques (Universidade Federal do Rio Grande do Sul)
Júlia Pinto Soares (Universidade Federal do Rio Grande do Sul)

Maternal care and the sense of property: a social understanding
Angela Donato Oliva (Universidade do Estado do Rio de Janeiro)
Gabriela Fernandes Castanheira (Universidade do Estado do Rio de Janeiro)
Débora Aguiar Soares da Cunha (Universidade do Estado do Rio de Janeiro)
Cristina Fátima Gomes Barroso Pereira (Universidade do Estado do Rio de Janeiro)

3:00-4:30 SY35 Symposium Session 35 ..... Angel

Using hierarchical complexity to determine how smart animals are

Organizer: Patrice M Miller (Salem State University)

An evolutionary theory of cognitive development must ultimately explain problem solving behavior in both human and nonhuman animals. While Piagetian theory has at times been applied to non-human animal behavior, this has been problematic since many of the behaviors studied in Piagetian research do not have equivalents in non-human animals. The Model of Hierarchical Complexity (MHC) posits that tasks can be ordered as to their hierarchical complexity. The order of hierarchical complexity of a task is obtained by counting the number of coordinations that the task action must perform on each lower order action until one reaches a set of elementary order actions. The Model posits fifteen orders of hierarchical complexity. Stage of performance has the same name and number as the task of the corresponding order of hierarchical complexity it correctly completes. This symposium will give an overview of a broad effort over the last several years to categorize the task actions of both human and non-human animals, covering stages from Stage 1, Sensory or Motor, up until the Concrete Stage. Only one or two species of animals are shown to perform some actions up to the concrete stage of complexity, about what 8 to 10-year-old children do. The symposium will also present an argument as to what human-acquired behaviors seem to make it possible to acquire stages above Concrete Operations.

The first three stages of development in animals
Andrew Richardson (Dare Institute)

Nominal and sentential stages: Examples of concept use and the organization of multiple concepts in animals
Patrice M Miller (Salem State University)

Preoperational Stage 6 and Primary Stage 7 performances in animals
Michael L Commons (Harvard Medical School)

The highest stage for animals? Examples of concrete operational animal behavior
Nicholas Commons-Miller (Dare Institute)

3:00-4:30 PS23 Paper Session 23..... Amador

Language

Chair: Emily Sutcliffe Cleveland (California State University, East Bay)

Enhancing children's memory and motivation to reminisce: A parental training study
Emily Sutcliffe Cleveland (California State University, East Bay)

Thirty parents observed their preschooler experience a standardized laboratory event. After the event, half of the parents were trained to provide autonomy-support in a follow-up parent-child conversation about the laboratory event; half the parents were trained to provide structure in the follow-up parent-child conversation. Parents discussed the laboratory event with their child later that evening. Autonomy-support-trained parents became more autonomy-supportive in the parent-child laboratory-event conversation compared to baseline; structure-trained parents became marginally more structurally elaborative. Experimenter-child memory interviews took place two weeks later. Children of structure-trained parents recalled more than children of autonomy-support-trained parents in these interviews and also provided more thematically coherent recall. Children of autonomy-support-trained parents, compared to children of structure-trained parents, were more engaged in the interviews. This pattern of findings is in perfect accord with the tenets of self-determination theory.

Language experience and preschoolers' foreign word learning
Jennifer Menjivar (University of California - Santa Cruz)
Nameera Akhtar (University of California - Santa Cruz)

We know that bilingual adults have an advantage in foreign word learning (Kaushanskaya & Marian, 2009), but it is unclear when this advantage develops. Four-and five-year-old children were taught names for familiar and novel objects in an artificial foreign language. Children were monolingual (N=16), English-Spanish bilingual (N=11), or regularly exposed to a second language (N=12). We hypothesized that knowing two labels for the familiar objects would allow bilingual and exposed children to learn more foreign words for these objects than monolinguals. Because no children had labels for the novel objects, we predicted that those with larger vocabularies (regardless of language exposure) would learn more foreign labels for the novel objects. Bilingual (M = 3.90) and exposed children (M = 4.0) scored higher than monolinguals (M=3.06) for the familiar objects, but the exposed children (M= 4.03) scored higher than monolinguals (M= 2.50) and bilinguals (M=2.63) for the novel objects. Analyses with vocabulary as a covariate revealed that the exposed children outperformed the other two groups even when vocabulary size was controlled for. Data collection is ongoing; future analyses will explore factors (e.g., metalinguistic awareness and contexts of language exposure) that may explain the foreign word learning advantage of exposed children.

The role of gesture in noun phrase development

Dea Hunsicker (University of Chicago)
Erica Cartmill (University of Chicago)
Susan Goldin-Meadow (University of Chicago)

English-learning children start to produce noun phrases around 2 years 6 months of age (Valian, 1986). During early stages of language development, children often use gesture to reinforce the information conveyed in speech (e.g., point at bottle while saying "bottle"). We examined whether pointing gestures of this type might be serving to specify the referent of the noun they accompany, thus serving a determiner-like function (e.g., point = that + "cat"). If so, these gesture-speech combinations ought to appear before the onset of noun phrases, and decrease after noun phrases have been established. We analyzed longitudinal data from 12 children (7 girls). We analyzed all child utterances containing nouns, focusing on those that included bare nouns produced with pointing gestures and those that contained a determiner modifying a noun. Ten of 12 children produced point+noun combinations before producing determiner+noun combinations. Moreover, production of point+noun combinations declined after the onset of determiner+noun utterances. This pattern held for 10 of the 12 children even though onset of noun phrases varied from 18 to 30 months. The pattern suggests that pointing gestures, when combined with bare nouns, may be functioning like determiners, thus setting the stage for the development of noun phrases.

Relationship between emergent literacy and early social-emotional development in preschool children

Minghua Tan (Purdue University)
Jennifer Dobbs-Oates (Purdue University)

Sixty-six preschool children and their parents and teachers participated in a cross-sectional study of the social-emotional correlates of emergent literacy skills. The children's emergent literacy skills were assessed with the standard language and literacy tests Expressive Vocabulary Test, Peabody Picture Vocabulary Test (3rd edition), and Test of Early Reading Ability (3rd edition). These tests measure oral language (both expressive language and receptive language) and print awareness. Children's positive and negative behaviors were measured by the standard behavior rating scales the Behavior Assessment System for Children (2nd edition) and the Devereux Early Childhood Assessment. These behaviors are grouped into four subcategories, namely, externalizing behavior, internalizing behavior, approaches to learning, and interpersonal skills. Results showed a wide range of significant associations between components of emergent literacy and social-emotional development. Age and sex were found to moderate these significant correlations in different ways.

Consequences of language diversity for human lives: The primacy of action

Jörg Zinken (University of Portsmouth)
Alan Costall (University of Portsmouth)

Work on the implications of language diversity for human lives is in a rut. Linguistic relativists have not provided convincing evidence that speakers of different languages 'think differently'. Equally, the insistence of their universalist opponents that people understand the world through a universal 'language of thought' has not settled the matter either. In this presentation, we suggest that behavioural researchers – relativists and universalists alike – have overemphasised the role of 'thought' in understanding human lives. We discuss assumptions which underpin this mistaken focus on thought and the historical contexts in which these assumptions have entered the debate on language diversity in order to make space for an alternative perspective. Our alternative proposal starts from the assumption that action (not representa-

tion) is primary in the development of mind and behaviour. Linguistic constructions are one of the semiotic resources implicated in the situated, moment-by-moment accomplishment of a range of activities that are characteristic of human lives, and diverse linguistic structures afford different action opportunities. In sum, we suggest that researchers interested in the implications of language diversity for human lives change the question from 'Does language influence thought?' to this question: How does one person's talk build the situation for another person's action?

3:00-4:30 SY36 Symposium Session 36 ..... El Dorado

Narrative practices and narrative doubts

Organizer: Michael Bamberg (Clark University)

This symposium is an attempt to connect recent criticisms of narrative imperialism (generally formulated as doubts in narrative as a privileged access mode to identity and sense of self) to a more viable Narrative Practice approach that views narratives as situated in communal sense-making practices. This more practice-oriented approach to narrating and narrative sees narrative forms (structures), narrative contents, and narrative functions as closely connected and practiced in everyday story-telling practices, where they become tools to establish a sense of self that (i) differentiates (and integrates) self vis-à-vis others, and (ii) navigates constancy and change so it can result in some sense of individual and communal continuity. Simultaneously, the Narrative Practice approach views and analyzes narratives as navigations between conflicting societal master narratives (ideological positions) that seem to have an existence previous to (and outside of) such situated practices of story-telling. In sum, this approach calls for more detailed observational and ethnographic studies of narrative practices that involve examinations of the narrative forms and contents used by particular cultural communities, how participants in cultural communities interact with these narrative forms and contents, the meanings participants associate with particular narrative practices and the transformation of narrative practices through interactions among participants. The symposium presentations illustrate and clarify these assumptions by discussing data from different populations. The first presentation will give a brief introduction to the Narrative Practice Approach, incorporating a brief demonstration of narrative practices among 10-year-old boys who navigate the contradictions of heterosexual desire and simultaneously test out the space between childhood and adolescent sexuality. The second presentation will focus on the development of narrative skills as a part of First Nations cultural communal practices that enable and facilitate the management of change and constancy in becoming a person. The third presentation makes use of youth narrations of conflicts in everyday life-experiences from four different positions of post-war Yugoslavia (Bosnia, Croatia, Serbia, and a U.S. refugee community), shedding light onto the differences and commonalities in narrative forms and content with regard to implicit conflicts and conflict resolution strategies. The final presentation will articulate a Narrative Practice approach as a means of exploring how adolescent girls made sense of the disjunction between cultural "master" narratives about growing up, and the realities of their lives as pregnant and parenting teens. The presentations will leave ample time at the end for a discussion that will be moderated jointly by the four presenters.

Narratives and narrative practice: Finding stories, but analyzing practices
Michael Bamberg (Clark University)

A narrative practice approach to the use of narratives within First Nations communities
James W Allen (University of Victoria)
Christopher E Lalonde (University of Victoria)

Between narratives – managing dramatically changing environments
Colette Daiute (The Graduate Center, CUNY)
Luka Lucic (The Graduate Center, CUNY)

Doubt and desire in teen mothers' identity talk
Cynthia Lightfoot (Penn State – Brandywine)

3:00-4:30 PS24 Paper Session 24.....Mariposa

Early Social Cognition

Chair: Nina Howe (Concordia University)

Positivity or reliability: Do young children use informant testimony to make global personality attributions about a stranger?
Janet J Boseovski (University of North Carolina at Greensboro)
Jamie Lee Peterson (Yale University)
Candice Lassiter (University of North Carolina at Greensboro)
Emilie Peterson (University of North Carolina at Greensboro)

Although children are discerning consumers of informant testimony in some domains (e.g., word learning), it is unclear whether they are as judicious in the context of social judgments. Indeed, young children exhibit a robust positivity bias in personality judgments about others that is often impervious to conflicting evidence. This study examined whether 3- to 7-year-old children would accept informant testimony about a stranger's personality that conflicted with their putative positivity bias (i.e., a negative trait attribution). Participants were exposed to a reliability training phase in which they watched two informants make judgments of niceness or meanness about individuals' behaviors. One informant was correct on all trials; the other was incorrect on all trials. In the test phase, participants watched as the same informants made a trait attribution about a stranger whose behavior participants had not witnessed. One informant labeled the stranger as 'mean' and the other as 'nice'. Overall, participants rated the stranger as 'nice' irrespective of the informant's trait labeling reliability, although they were more likely to accept labels from informants with accurate than inaccurate labeling histories. Evidently, information processing biases have a profound impact on children's use of informant testimony to learn about the social world.

How children's understanding of physical possibility constrains their acceptance of extraordinary testimony
Andrew Shtulman,(Occidental College)
In Kyung Yoo (Occidental College)

Children's understanding of physical possibility has been shown to undergo dramatic changes between the ages of 4 and 10, with young children failing to differentiate events that violate physical laws (impossible events) from events that violate empirical regularities of a more superficial nature (improbable events). Does this transition influence their acceptance of physically impossible entities, like Santa Claus and the Tooth Fairy? We addressed this question by comparing children's ability to differentiate events that do and do not violate physical laws to their skepticism toward Santa Claus, as measured by (a) the kinds of questions they asked Santa and (b) the kinds of explanations they posited for Santa's extraordinary abilities. It was found that children who were better at differentiating improbable events from impossible events had also begun to engage with the mythology surrounding Santa at a conceptual level, questioning the feasibility of Santa's extraordinary activities while also positing "placeholder" explanations for those activities in the absence of a known answer. These findings suggest that children's

acceptance of testimony about Santa – and possibly other forms of counterintuitive testimony – is dependent not just on the consistency of that testimony but also on the child's own conceptual abilities.

Culture, context, and children's trust in testimony

Cheri C Y Chan (University of Michigan)

Learning is a continual process of reconciliation. For example, young preschoolers may need to reconcile their older siblings' insistence that the earth is actually round with their own perception of the earth as flat. At what age do children become sensitive to the strength of their own beliefs, and use this to guide their endorsement or rejection of what other people say? Furthermore, how do people's attitudes about learning, as shaped by communities and cultures, affect the way they learn from others? In a categorization task, US and Chinese children (K and 2) heard unexpected labels for ambiguous and non-ambiguous objects presented by a confederate teacher. Endorsement of the teacher's labels and children's spontaneous comments were analyzed. Findings revealed that children in both locations showed metacognitive awareness by adapting their level of trust in relation to the strength of their prior beliefs. Intriguingly, US kindergartners were more likely than their Chinese peers to endorse unexpected labels from a teacher even when their own prior beliefs were strong, but were also more likely to engage the teacher via their spontaneous comments. Findings will be discussed with respect to the ways in which children are socialized as learners across cultures.

Sibling teaching during naturalistic home observations

Sandra Della Porta (Concordia University)
Nina Howe (Concordia University)
Hildy Ross (University of Waterloo)

The purpose of the present study was to investigate sibling teaching during naturalistic home observations, a context in which children reveal their social-cognitive understanding (Dunn, 2002). The sample included 4- and 6-year-old children from 40 2-parent families; older children's mean age = 6.4 years and younger children's mean age = 4.4. Each family was observed for six 90-minute sessions at home (Ross, 1996). Codes were assigned to teaching behaviors (e.g., direct instruction demonstration, explanation) as well as type of knowledge (i.e., conceptual, procedural, or both). Findings indicated that older siblings taught for 76.9% (n = 830) of the teaching sequences. Based on a MANOVA, older sibling teachers used demonstration, clarification, positive feedback, and negative feedback more than younger sibling teachers. Male older siblings taught more than female older siblings. Data also revealed that 71.1 % (n = 767) of teaching sequences involved conceptual knowledge, 16.9% (n = 182) of the topics were procedural knowledge, and 11.9 % (n = 128) consisted of both conceptual and procedural knowledge. Our findings illuminate our understanding of sibling teaching and indicate that the process whereby one child is acknowledged to be an expert is complex and requires further, detailed examination.

Sibling teaching during naturalistic home observations: What mathematical topics do children teach their siblings?

Nina Howe (Concordia University)
Sandra Della Porta (Concordia University)
Brittany Scott (Concordia University)
Helena Osana (Concordia University)
Hildy Ross (University of Waterloo)

With the notable exception of recent ethnographic work (Maynard, 2002, 2004; Volk, 1998), little research has examined sibling teaching during naturalistic home exchanges, particularly in terms of

teaching of mathematical concepts. The present study investigated sibling teaching during naturalistic home observations to determine (a) the frequency of sibling teaching in general, and (b) specifically about mathematical topics, (c) the types of mathematical topics taught, and (d) associations with type of knowledge (procedural, conceptual). Forty sibling dyads (aged 4 and 6) were observed over six 90-minutes sessions and 1079 teaching sequences were identified in the transcripts; preliminary analyses indicated that 178/1079 sequences involved mathematical topics (particularly number, geometry and measurement). Siblings referred to conceptual knowledge most frequently (71%), followed by procedural explanations (17%), and sequences including both conceptual and procedural knowledge (12%). Procedural knowledge was employed during the teaching of the topic of grouping, whereas both types of knowledge were used during the teaching of geometry. Age and gender findings were evident for the teaching of some mathematical topics (i.e., grouping, relations). Findings are discussed in light of recent work on understanding the mathematical knowledge of young children and the contexts in which they teach and learn this information.

4:30-4:45 break

4:45-5:45 BOOK Book Discussion Session ..... Ballroom

Book Discussion Session

This year's focus is on two readings: Inhelder and Piaget (1958) *The growth of logical thinking from childhood to adolescence*, and Piaget (1972) *Intellectual evolution from adolescence to adulthood.* With special permission from the publisher, we will be e-mailing copies of the Piaget (1972) *Human Development* paper to all conference registrants in advance of the meeting. Our discussion will be facilitated by Eric Amsel (Weber State University) and Ashley Maynard (University of Hawaii).

At the end of the book discussion session, Geoffrey Saxe, our outgoing president, will close the meeting, and Phil Zelazo, our incoming president, will highlight next year's conference in Toronto Canada.

We end (as always) with wine and tearful good byes...

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JPS Officers & Board

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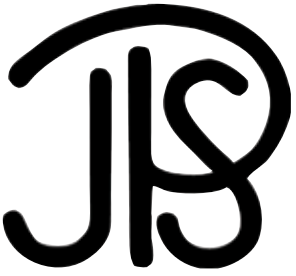

Want to organize an Annual Meeting?

Submission Guidelines for Program Proposals

The following guidelines are intended to assist prospective organizers in developing program proposals for review by the JPS Board of Directors. The submission process involves two steps. The first is to bring forward a preliminary proposal that provides a rough overview of the intended theme; the second involves a more fully developed plan for the organization of the program, and more detailed information on the invited speakers.

Preliminary proposal

The purpose of the preliminary proposal is to initiate a dialog with the Meeting Planning Committee. The brief overview should include a suggested title, a description of the theme, a statement regarding the relevance and interest of the theme to the JPS membership, and a list of potential invited speakers. If the proposal is believed to merit further development, the prospective organizer(s) will be asked to submit a more fully developed plan.

Full proposal

The full proposal should include the following sections:

1. A 2-3 page statement of the theme, including a description of its relevance to developmental inquiry.
2. A description of the relevance of the theme to the JPS membership.
3. An outline of the invited program, including suggested plenary speakers and invited symposium organizers.
4. A brief biographical sketch of invited speakers.
5. A suggested venue and prospective local arrangements team, if appropriate. (NB: It is not necessary for the program proposal to include a specific venue and local arrangements plan; this component of the program may be coordinated through the Meeting Planning Committee.) For more information, contact the VP, Program Planning: Larry Nucci (nucci@berkeley.edu).

Cognitive Development — Special Issues

Cognitive Development includes articles dealing with social cognition and development that are of particular interest to JPS members. Deanna Kuhn, the current editor, is also open to theoretical articles that are brief, and interesting. *Cognitive Development* is now accepting electronic submissions. For details, visit: http://www.elsevier.com/locate/cogdev

To insure a JPS contribution, the board will select a special issue editor each year to produce one volume.

Guidelines for Annual Special Issue Proposals

The following guidelines are intended to assist prospective guest editors in formulating a proposal and editing an annual special issue of Cognitive Development. Proposals for the 2012 and 2013 Special Issues are now invited.

Focus: The special issue should concern a topic central to the interest of the JPS membership. The issue represents the annual contribution of the Society. Theoretical and empirical scholarship will be considered.

Format: Generally we are seeking a series of related articles rather than other formats, though these would be considered if well justified. Proposals based on conference symposia can be submitted.

Process: The potential guest editor should submit a two-three page proposal to the Publications Committee Chair for review by the publications committee and subsequent approval by the JPS Board.

The proposal should include:

- suggested title
- description of the theme
- statement regarding the relevance and interest of the theme to the JPS membership and general readers of *Cognitive Development*
- list of potential invited contributors and brief description of their individual papers (please note that except under unusual circumstances, we expect that guest editors will not author or co-author a paper)
- list of three to four colleagues who could potentially act as an ad hoc review committee, as well as a brief description of their background
- timeline indicating when the guest editor plans to receive the articles, have them reviewed, received and proposed date for when the entire volume would be ready for publication.

Review: All manuscripts will be submitted to the Guest Editor. The Guest Editor will then seek two independent reviews for each manuscript. These external reviews will be returned to the Guest Editor who will then write an action letter to each author. Revisions will be returned to the Guest Editor who will make a decision as to the readiness of the paper for publication. The guest editor will forward the completed Special Issue on to the editor of *Cognitive Development.*

For more information, please contact Katherine Nelson (knelson@gc.cuny.edu)

Jean Piaget Society DVD Series

The Growing Mind: A Piagetian View of Children

Produced by Keith Alward

This set of four broadcast-quality, full-color, DVDs covers the cognitive development of children between four and eight years of age in four domains of knowledge, with one DVD devoted to each domain:

- → The Development of Classification (30 minutes)
- → The Development of Order Relations: Seriation (28 minutes)
- → The Development of Quantitative Relations: Conservation (32 minutes)
- → The Development of Spatial Relations (29 minutes)

Each DVD is narrated and self-contained. Across the four DVDs, interviewers, in conversation with 13 children, reveal Piaget's pre-operational, transitional, and concrete-operational stages. Many of the same children appear in several of the DVDs, permitting analyses of case studies of individual students' thinking across knowledge domains.

The Jean Piaget Society relies on the generous support of our members and affiliates. DVDs in this series are available as a gift with your donation of $100 for one DVD, or $300 for the set of four.

A new added benefit to members is a 20% discount on the DVD Growing Mind film series, a valuable addition to course material in undergraduate, pre-service, and graduate courses in cognition and development.

"I have used The Growing Mind series in a course for students who are preparing to teach in elementary schools. It has been an invaluable resource, not only for helping my students understand Piaget's stages of development, but also for illustrating some effective questioning strategies that they can use to assess and promote their own students' understandings of the curricula they teach."

(Paul Ammon, Professor & Director, Developmental Teacher Education Program, UC Berkeley)

For details, visit: www.piaget.org/video

JPS 2012 — Toronto, Canada

The times they are a changin'….

Find out how at JPS 2012 in beautiful downtown Toronto:

Rethinking Cognitive Development

The first of three meetings on Knowledge & Development in the 21st Century

42nd Annual Meeting Organizers: Phil Zelazo and Stephanie Carlson

31 May – 2 June, 2012

JPS 2012 will be the first in a three-conference sequence (2012: Cognitive Development; 2013: Social Development; 2014: Thought and Language) that explore new ways of conceptualizing human development in light of recent advances in other disciplines (e.g., neuroscience, epigenetics, systems theory, evolutionary theory, cultural analyses, and epistemology, among other fields of inquiry). The organizers draw upon these advances to highlight a more holistic, relational view of human beings as dynamic and multidimensional, with analytic foci that are simultaneously behavioral and neural, cognitive and emotional, individual and social. The combined aim of the three meetings is to re-think developmental issues across domains from the perspective of contemporary science.

The first meeting will focus on this emerging view of cognitive development, and explore its varieties and motivations. Questions return to the Society's first purposes: What are the mechanisms of developmental change? How does the environment, including culture, interact with genes and behavior to yield a developing person? What is the role of subjective processes, such as self reflection, in cognitive development? What new ways of modeling cognition and its development are needed to characterize cognitive development as an extremely complex emergent process?

Plenary speakers include:

Richard Davidson, Annette Karmiloff-Smith, Carol Lee, Willis F. Overton, and Linda Smith

A Call for Program Proposals will be issued in September 2011

For additional information, please see: www.piaget.org

42nd Annual Meeting of the Jean Piaget Society

Rethinking Cognitive Development

Toronto, Canada, 31 May – 2 June 2012

The times they are a changin'...

Find out how at JPS 2012 in beautiful downtown Toronto

(see inside back cover for details)

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