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DRAFT Paper

**Numeracy Practices and Classroom Imperatives:
Chutes and Ladders Travels between Home and School**

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I am reporting on a one year pilot study spanning the 2001 and 2002 school years. In our presentation today we show a young child carrying his mathematical learning across the settings of home and school. We argue that teachers, constrained by the imperatives of the classroom, such as pressure to regulate social behavior and focus on assessments, too often miss the knowledge that travels with children to school from their home and community. Nonetheless, we found that sharing vignettes, like the one I will tell today, that illustrate the potential in the intersection of home and school numeracy practices, hold promise as powerful professional development. They can interrupt assumptions and provoke alternative discourses to the usual kinds of teacher “talk” about low-income, often minority families and their deficits, and stimulate reflection on and change in practice.

We carried out our research in an elementary school in Philadelphia, located in a low-income working class African American neighborhood. We selected a school which met the following criteria: a principal interested in participating in the research; a faculty ready to address mathematics teaching and learning and open and curious about what might be learned by looking at mathematics in the home as well as in the classroom; a school with a feeder Head Start program so we could begin with children still close to their at-home experience; and a school where children were underachieving in

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mathematics, as measured by state assessments. The research team was inter-racial, which we believe benefited both our interaction with the subjects of our inquiry and our analysis. The faculty selected the focal classroom. In consultation with the lead Head Start teacher of the focal classroom, we selected four children for case studies. We asked the teacher to suggest children who, in her mind, represented an academic and social range.

Our study was theoretically guided by the research of those who consider learning as situated social practice (Lave, 1992; Lave and Wenger, 1991; Walkerdine, 1988), as well as recent studies looking at the ways in which numeracy and mathematical thinking are embedded in the social life of the home and community as well as in classrooms (Lerman, 2000). We looked to a range of work, most emanating from the studies of literacy, to theorize the “travel” of mathematical practices across settings and domains. Our methodology borrowed from New Literacy Studies which promote the idea of looking at literacy within the broader social contexts which give reading, writing, and oral communication meaning (see Gee, 1996; Gregory and Williams, 2000; Heath, 1983; Street, 1997).

Our primary focus was on what Cole (1996) describes as the child in activity. We observed children in the course of their everyday lives in and out of school, and talked with adults who interact with the child, as well as the child, about his/her engagement in social activities. Because we were interested in social activity, we employed qualitative methods, observing and conducting interviews -- of parents and grandparents, teachers, principal, school counselors, and other school leaders -- in order to gather multiple perspectives on what we were observing. We also reviewed archival documents, including the School District of Philadelphia School Profile and school and classroom newsletters sent home to families.

In order to make visible the phenomena of children engaged in social activity, we created vignettes from our data. For these vignettes, we selected data which, in our judgment, showed “numeracy in practice.” Again borrowing a concept from the field of literacy—that of literacy events (Heath 1983) our vignettes were meant to capture “numeracy events,” defined as those “occasions in which a numeracy activity is integral to the nature of the participants’ interactions and their interpretative processes” (Baker, 1996 cited in Baker, 2002, p.3).

In the remainder of this talk I present one vignette and then briefly discuss it. I will then turn to some of the reflections of the teachers and educators to whom we presented the vignette.

A Vignette about Danny¹

Danny is a bright-eyed 3 ½ -year old child in his first year of Head Start. He has dramatic and changeable moods: sometimes energetic and engaged and at other times despondent.

¹ We use pseudonyms throughout this paper for names of children, teachers, and the school.

When his teachers were asked to assess him academically and socially, they responded that he is “in the middle range.”

The following vignette describes three numeracy events that took place on one day in Danny’s class: Danny playing a game, *Chutes and Ladders*, with one of the researchers; Danny playing the same game with the teacher; and Danny responding to the teacher’s request to count the students and adults in the classroom. These three events occurred in close proximity, and each sheds light on the others.

FROM FIELDNOTES

Classroom Visit

Danny is sitting at the small game table when we enter the classroom. I go over to the table and sit and Danny asks me to play *Chutes and Ladders*. Danny gets the game and sets it up, instructing me on where I should place my marker to start the game. He goes first, taking the dial and spinning it, landing on the number 5.

When he moves his marker he double counts on the first and second spaces, landing on the third space, which has a ladder so that he advances. I take my turn, spinning and moving in one-to-one correspondence with the number I land on the spinner. As the game progresses, Danny continues to be able to identify the numerals on the spinner and moves his marker to land on ladders and avoid chutes, double counting when necessary.

When Danny is sufficiently ahead of me, and there is no chute nearby, he moves in a one-to-one correspondence with the number he spins. The game of *Chutes and Ladders* “snakes” from left to right and then around from right to left and so forth. Danny does not follow this pattern but moves from left to right, beginning again at the left when he finishes a line. As we begin to play, the teacher walks past and comments to me that Danny likes to win, that he will “cheat.”

As the game progresses and Danny is winning, he stands in front of his seat dancing a little jig of excitement after each of his moves. The game is over and Danny has won in less than 8 minutes.

The teacher comes by and asks Danny how many children are in the classroom today. He walks around and touches each child and counts to three. Then she asks him how many grownups. He goes around and counts five and she asks him to go try again and this time, touching each as he counts, he gets 4. Then she asks how many children and adults. He touches each child and adult as he counts to 7, touching himself last.

The teacher gives him a high five for his good work, mentioning especially that he did not forget to count himself. He then asks her to play *Chutes and Ladders*. Instead of the game spinner, he wants to use a play clock for the spinner, saying it would be “new.” The teacher warns Danny, “I won’t let you be a ‘cheater.’”

Nonetheless, he begins by counting in a similar manner as when he played with me, trying to ensure that he ends up on a ladder, but the teacher stops him and insists he count the spaces in one-to-one correspondence with the number he landed on the clock. Throughout the time they are playing the

teacher monitors him, putting the emphasis on playing the game according to the rules and instructing him on how to follow the snake pathway around from left to right, right to left, and so forth. After about 10 minutes neither has progressed very far, having landed on chutes a number of times, and it is time to clean up to go outdoors. This time, Danny did not do any jigs.

Home Visit

On a home visit, I learn that Danny's grandparents are important caretakers and that they have the primary interaction with his teachers. I observe that Danny's grandparents provide him with many toys, including many games. Danny's grandmother is a volunteer at the local Catholic School down the street, where she previously worked for pay, and where she now keeps the records for the free lunch program. When asked in an interview about how she uses math in her life, she responded, "Everything, you can't do without math. I work in school here [keeping track of the lunch money] and do the paperwork. I do the budget for the home. The money goes in the bank and I keep up with it." She also told me, "Danny counts. He will count everything. Legos is his favorite, but he has 'football men' and he uses the carpet as the 'field.' He sets it up and counts the men. Sometimes he will have nine on this side and ten on the other. I'll tell him, 'You have too many men on the field. You better count them again.' Same with the legos, he'll say 'Nana, you take five and I'll take five' and he'll count them out. We have legos and ABCs on the refrigerator. He'll count ten and put some on this side and others on that side. Before he came to preschool, he played with legos at home. He plays with everything. He tells me he wants to take five cars outside and he counts them and takes out only five and he brings them all back."

Parent-Teacher Conference

At the parent-teacher conference the teacher first told the grandmother that she would like her to encourage Danny to look at books -- "to take books by himself to the couch and look at them." She also gave the grandmother 3 blocks of different sizes, urging her to help Danny learn small, smaller, smallest, comparisons that he needs to perform for the Head Start Core Assessment.

When the teacher finished talking to the grandmother, she asks me if I want to add anything. The grandmother turns to me and tells me "Danny is not really into numbers yet. [But] he can count." The teacher comments that he can count up to 18, then it goes, "21, 23..." The grandmother explains how she tells him to slow down and then he can say "19, and if he pauses, 20."

I ask the grandmother about games and she responds that *Chutes and Ladders* is his favorite. The teacher comments, "It [*Chutes and Ladders*] takes a long time." The grandmother says, "He cheats. He has something where he has to win [even though] I tell him he has to lose sometimes."

I tell the teacher and grandmother my observation of Danny manipulating his counting to win and the teacher comments, "I didn't see that!" I share my thought that Danny, in his desire to win, has developed strategies that show arithmetic awareness. The grandmother comments, "He is very smart, but he has to win."

Discussion of “The Danny Vignette”

This discussion of the vignette was informed not only by our classroom observations, but also by an observation of Danny’s parent-teacher conference, and a home visit and interview with his caretakers.

We describe Danny playing the game *Chutes and Ladders* in two different social contexts, although both occur in his classroom. The first time, he is playing with me and I allow the game to be child-directed, and am not concerned with whether Danny is following the rules. Danny shows confidence and familiarity with *Chutes and Ladders*, setting up the game and instructing me where to put my piece to play. Danny’s objective in playing the game is to win, made obvious by his jig of delight after each of his moves that put him ahead in the game. When playing with me, Danny employs strategies he has developed for winning, which include manipulating his counting in order to land on symbols (ladders) that advance him and avoid symbols (chutes) which might set him back and cause him to lose. Watching him “count” makes it clear that he is not following a random process, but is able to predict how many times he must double count in order to either land on a ladder or avoid a chute. It is also clear that he can count in a one-to-one correspondence to the number he spins, since he does that when he is well in advance of the researcher and in no danger of landing on a chute.

When Danny plays the same game with his teacher, it is teacher-directed. The teacher’s purpose for playing the game differs from Danny’s; while he would like to play to win, she plays to reinforce the value of following rules (i.e., not being a “cheater”) and practicing skills such as counting and learning to follow the snake pattern of the path on the board. For the teacher, the game is an instructional tool. The context of classroom leaves invisible the double-counting strategies to win that Danny has developed in contexts where the game is played for pleasure.

Danny’s home had games and his grandmother described his particular fondness for *Chutes and Ladders*. At home, where the game was used for pleasure, Danny’s objective of winning was permitted to override a requirement to follow the rules of the game. We therefore presume that Danny developed his strategies for winning, which involved arithmetic concepts, at home. From both the way in which he counts the children and adults in the class, employing the touch and count method familiar to him from counting moves on the game board, and from my co-researcher’s interview with his Grandmother, it is clear that Danny knows how to count; in fact, he can count well beyond the value of the 1-12 numerals that are either on the spinner or the clock he uses the second time he plays the game.

Although there is not time for a full discussion of the issue of knowledge “travel,” (Anderson, 2003) I want to note that there are common words and concepts used to describe how mathematics ‘travel’ across home and school sites and across domains of playing and learning. Knowledge travels across domains and sites is variously

characterized as psychological transfer, syncretizing (Gregory & Williams, 2000) , circulation (Schultz, 2002), translation (Cook-Sather, 2001), harnessing (Lerman, 2000), code-switching (Baker, 2003), etc.

When we look to literacy accounts the concept of “permeability” (Dyson, 1997) shows us that there are impediments to the movement of knowledge that are both structural and conceptual. At a concrete level the schoolhouse door or the presence of the teacher can signal a leaving behind of one set of practices as a new site or domain is entered.

What Bourdieu has identified as *habitus*, or structuring system, conceptually signals a set of appropriate practices. Danny’s home habitus invites the practice or strategy of double-counting to win as well as doing a jig. For Danny, these are both aspects of play, or how he plays the game. He enacts them spontaneously, perhaps without “consciousness or will” (Bourdieu, 1999, p. 112), when the social conditions evoke them. When playing Chutes & Ladders in school and it is structured more like home, where winning is the goal in playing against me, Danny brings his double-counting strategy, and his jig, into the game. He is disposed to practice double-counting and dancing. When he plays with the teacher, however, she introduces the imperatives of the preschool classroom, to socialize students to follow rules and not “be a cheater” and to practice the basics of counting. The possibilities for Danny become constrained and the teacher misses the opportunity to build on what Danny can do, which could affirm him as a mathematical learner. More importantly, in the rule bound, regulated school *habitus*, Danny loses his joy (the jig) and his invention (double counting), which could be gateways to mathematical learning. Rather than a promising mathematician, his identity is being constructed as a problem.

Presentation of the Vignette and Audience Responses

In the fall 2002 and spring of 2003, we made presentations about the pilot project to several audiences of teachers and central office administrators, each audience included both Caucasians and African Americans, and sometimes Latinos as well.

Although our original intention in sharing the vignettes was to enrich our interpretation with those of practitioners, we suggest that using the vignettes as source material for professional development sessions can lead to provocative discussions and new possibilities for classroom practice. Here we offer a selection of the responses we heard to the Danny vignette in the session we did with teachers and the principal at Danny’s school. In these we focus on two major areas: The first was judging Danny’s preparation for success in school and in the future more generally; the second was on judging the caregivers’ approach to raising and instructing Danny. The Kindergarten and first grade teachers do not speak with one voice; we believe that the tension raised by their different interpretations provides a stimulus that can lead to new possibilities for understanding Danny and his mathematical abilities, and for teacher discourses about families such as Danny’s.

Comments about Danny's possibilities for school success

A large majority of teachers' responses to the vignette focused squarely on the "unsocial" and "unschooled" aspects of Danny's game playing. These teachers focused more on issues of socialization and less on mathematics. From their interpretations of the vignette, it was clear that some teachers worried that Danny was not well socialized. One teacher's comment even went so far as to allude to future criminal activity if his behavior persisted. An example of the preponderant response was, "He has to win all the time. He has to learn you can't win all the time. There are rules. Things are set up in certain ways for a reason; he should be taught that right from the start." On the other hand, a small number of respondents praised Danny's game playing as showing intelligence and creativity. One of these teachers remarked, "The child is clever. He knew he had to do certain things to win. ..." "He has number recognition and good problem-solving strategies. He could explain how to play to win the game [which shows] he can sequence verbally."

Some in the group worried that Danny's failure to follow the rules of the game in *Chutes and Ladders* predicted failure in the District's newly mandated Everyday Math curriculum. For example, one teacher commented, "With Everyday Math students have to work in cooperative groups of two or three, like [for] rolling dice. He will not always be the one to control the game. He will not always win." On the other hand, a small number of teachers thought he would easily adapt to the new curriculum since he displayed a good command of numbers. "He has a good number sense; he liked to manipulate. He will love Everyday Math; he will get to roll the dice."

Comments about Danny's Caregivers

Although Danny's caregivers received praise for providing learning opportunities at home, the majority of teachers were critical of the manner in which the caregivers provided instruction. Several participants did make positive comments about the caregivers' efforts to engage Danny in school-like activities at home and provide games from which he could learn. At the same time the teachers tended to blame the caregivers for deficiencies in socializing the child while involved in those activities. Some teachers believed that caregivers' failure to instruct children to "follow directions" makes their jobs more difficult; they made statements like the following: "I wonder if his parents go by the guidelines and have him follow directions. He should learn that events lead up to things; there are rules." "The parent/caretaker deal[s] with the child on one level and forget[s] he is one of many in school. It's important for him to follow the rules." In addition, in the case of Danny, some teachers spoke about the caregiver's limited knowledge of the different facets of the game that strengthen mathematical thinking, presuming she only saw the activity as recreational. "There's not a connection to the grandmother's numeracy math understanding [of the game]. It's limited with what else is understood more than numbers and counting. [It] reflects her understanding of what math is."

A minority of alternative voices did not worry about the child's future success because they found his behavior "on par" with other children his age: "Home and school [both] are teaching him the right way to do things. Kids are egocentric and want to win. He is a good thinker." "[What stood out to me was] how competitive kids are at this age. How he wanted to stand out."

Summary of Responses

The sessions with educators demonstrated that classroom teachers often believe that children's learning experiences at home should reinforce school practices. The discussions of the Danny vignette show that when learning at home is regarded through a school lens, purposes for at-home activities can become lost and the home as a learning environment that brings its own strengths and contributions can be overlooked. When this occurs, not only is the home often cast as deficient, but teachers miss opportunities to work with parents to create bridges between the ways in which mathematics is learned out of school and in the school context. These sessions also showed, however, that when teachers have opportunities to reflect on their practices as a group, alternative points of view surface and begin to challenge otherwise taken-for-granted assumptions. These disruptive moments are ones we found of most interest and promise for practice. For example, despite the discomfort we anticipated the vignette might generate for the focal teacher, she emailed us: "Thank you for doing this study...it has already helped me to become a better teacher through evaluating myself and making changes." A year later she described to us small changes she was making in her practice." The principal of the school, who strongly supported this research, believed the process of staff reflecting on the vignettes reinforced a culture of teachers' learning from their practice—a culture he is trying to develop in his school within a larger District climate that is increasing regulated and assessment-driven.

Concluding Thoughts

Parents are often in the position of bridging sites and domains. They buy workbooks, computer programs, and other school-like apparatus for imparting school knowledge to their children. Many provide time, space and support for homework. They do not question the passage of school activity into the home. The hegemony of schooling requires that the home be permeable to schooling in order for success to be obtained for their children.

Yet even in the preschool Head Start classroom, where mainstream childhood games and materials abound, what Danny can bring into the classroom in terms of his habitus, structuring systems of activity and thought, is highly regulated. For while he can play Chutes and Ladders, his favorite game from home, he cannot play *as he does* at home. Thus, the teacher does not see his double-counting as mathematics and it is therefore unavailable to her and to Danny for further mathematical learning. Therefore, drawing upon children's home knowledge is not merely about placing the artifacts of home in the classroom. What is also required is an understanding of the implicit regulations that

signal to Danny that he must leave double-counting behind and not practice it in school activity.

While teachers tend to aim in the direction of school to home, teaching mathematical concepts, skills, and algorithms, they are challenged to harness (Lerman, 2000) what children know from home and bring into the classroom. Teachers, too, must travel across sites and domains, and structure curriculum to cross domains and to be permeable to out-of-school practices. They must do so in order to create contexts that will signal the use of mathematical practices that travel on the backs of such things as childhood games. A permeable classroom is one that invokes tasks meant to draw upon a wide range of knowledge. It is one where children do not check what they know at the classroom door. It is one that provides the signals, explicit and implicit, for children to draw upon all that they know to be readers, writers, problem-solvers, and thinkers. Most importantly, our data points toward the fact that mathematics achievement or underachievement has roots early in schooling and are at least in part shaped by social factors, often unobserved, that cannot be summed up through simple categories of class or race.

References

- Anderson, D.D. (2003). Theorizing the descriptors of the ‘Travel’ of home and school numeracy practices. Paper prepared for the American Educational Research Association Annual Meeting, Chicago.
- Baker, D. A. (1996). Children’s Formal and Informal School Numeracy Practice in D. Baker, J. Clay and C. Fox (eds.) *Challenging ways of knowing in English, Maths, and Science*. London: Falmer.
- Baker, D., Street, B. & Tomlin, A. (2002). Maths as social: Understanding relationships between home and school numeracy practices. Paper prepared for the American Educational Research Association Annual Meeting, 2003.
- Baker, D. (2003). Researching home and school mathematics practices in the early years: A case study from the UK, presentation at AERA Annual Meeting, Chicago.
- Bourdieu, P. (1999). Structures, Habitus, Practices. In A. Elliott, (Ed.), *Contemporary Social Theory* (pp. 107-118). Malden, MA: Blackwell Publishers.
- Cole, M. (1996). *Cultural psychology: A once and future discipline*. Cambridge, MA: Belknap press of Harvard University Press.
- Dyson, A. H. (1997) *Writing Superheroes: Contemporary Childhood, Popular Culture, and Classroom Literacy*, NY: Teachers College Press.
- Gregory, E. & Williams, A. (2000). *City Literacies: Learning to read across generations and cultures*. London: Routledge.
- Heath, S. B. (1983). *Ways with words: Language, life and work in communities and classrooms*. New York: Cambridge University Press.
- Lave, J. (1992). Word problems: A microcosm of theories of learning. In P. Light & G. Bull (Eds.), *Context and cognition: Ways of learning and knowing*. Hertfordshire, UK: Harvester Wheatsheaf.
- Lave, J. & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York: Cambridge University Press.
- Lerman, S. (2000). The social turn in mathematics education research. In J. Boaler (Ed.), *Multiple perspectives on mathematics teaching and learning* (pp. 19-44) Westport, CT: Ablex Publishing.

Street, B. (1997). The implications of the 'new literacy studies' for literacy education.
English in Education, 31(3).

Walkerdine, V. (1988). *The mastery of reason: Cognitive development and the production of rationality*. London: Routledge & Keagan Paul.

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