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Identity, Goals, and Learning: Mathematics in Cultural Practice

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In this article, I explore and elaborate the relation between goals, identities, and learning and argue for their utility as a model by which to understand the nature of learning in general and to better understand the way in which race, culture, and learning become intertwined for minority students in American schools. Drawing on sociocultural perspectives on learning and development, including Wenger (1998) and Saxe (1999), I describe findings from 2 studies of learning among African American students outside of school, in the cultural practices of dominoes and basketball. This research shows that indeed, as players come to learn these practices, they both shift in regard to the goals they seek to accomplish within the practice and change as they come to define themselves vis-à-vis the practice. The implications for understanding the relation between race, culture, and learning are discussed.

The relation between culture, race, and mathematics learning has increasingly been of interest to the mathematics education community. One approach to this topic has been to compare the mathematics achievement of different racial groups. Studies from this perspective have repeatedly indicated that African American and Latino students score lower on tests of mathematical knowledge (Johnson, 1984; Lindquist, 1990; Lockheed, Thorpe, Brooks-Gunn, Casserly, & McAloon, 1985; Reyes & Stanic, 1988) and take fewer and less advanced mathematics courses (Campbell, 1986; Secada, 1992) than do White and Asian students. However, these achievement statistics only tell a partial story; they do little to help us understand the causes of the inequities or the processes that underlie them.

Recent research both in mathematics education and on culture and schooling more generally have made important contributions toward the development of a

more complex and textured understanding of the relation between culture, race, and mathematics learning. In mathematics education, scholars have argued that learning mathematics is more complex than can be represented by grades and standardized test scores (Heibert & Carpenter, 1992; Martin, 2000). Documents such as the National Council of Teachers of Mathematics (1989) *Curriculum and Evaluation Standards for School Mathematics* reflect a growing body of work focusing on the importance of the nature of students' understandings and the mathematical meaning created by students as they participate in mathematical activities. Studies have shown that many students can do mathematics (i.e., they can apply formulas to get numerical answers) but may not understand the concepts behind the procedures they learn to apply. More than just knowledge of procedures and formulas, understanding also includes the concepts and mathematical relations that underlie those procedures (Ball, 1993; Heibert & Carpenter, 1992; Lampert, 1990). Further, recent research in math education has viewed teaching as involving socializing students into the norms and discourse practices of the mathematics class (Cobb, Wood, & Yackel, 1993; Greeno, 1998) and fostering students' ability to see themselves as "doers of mathematics" (Boaler, 1999, 2000). As such, work in math education differentiates learning (as a process) from achievement (as a static outcome) and emphasizes the importance of viewing math classrooms as communities of practice (Lave, 1988; Lave & Wenger, 1991; Wenger, 1998), thereby highlighting new concerns around how students become (or do not become) part of these communities.

In research on culture and learning, studies have documented multiple dynamic factors in the gap in school achievement between White students and students of color, including differences in interaction styles, communication norms, and discourse practices (Au, 1980; Cummins, 1986); internalization of perceived and real societal limitations on success (Giroux, 1983; McLeod, 1987; Ogbu, 1992); and tracking practices in school (Oakes, 1984, 1990). Many of these factors are purported to impact learning directly, influencing the communication between teacher and student. Others have argued that some of these societal and classroom factors partially influence learning through their contribution to the development of an "oppositional identity" (Fordham & Ogbu, 1986), whereby minority students identify themselves in opposition to the mainstream school culture and thus fail in school as a part of the playing out of this identity. This line of research points to the multiple ways culture and race influences schooling processes and raises the centrality of the relation between learning and the identities that students develop as they become members of communities of practice.

Research on mathematics learning outside of school, although not concerned explicitly with race, has also shed light on the relation between culture and learning. In studies of a number of activities, including carpet laying (Masingila, 1994), farming (de Abreu, 1995), construction work (Carraher, 1986), dairy-case loading (Scribner, 1984), and candy selling (Saxe, 1988, 1991), scholars have used a

sociocultural perspective to focus on how mathematics learning is linked in fundamental ways to the cultural practices in which it occurs. This work focuses on cultural practices (vs. racial groups) as the unit of analysis, thereby attempting to “unpack” culture by studying people within cultural activities. One important and consistent finding in this research has been that mathematics (and other problem-solving activities) occur as individuals carry out goals in the course of everyday activity (i.e., to save money at the grocery store and buy a week’s worth of groceries)—activities that may not themselves be inherently mathematical in nature.

These explanations of how and when cultural activities give rise to mathematics learning have helped researchers to view math learning through a cultural lens and to better understand how mathematical activity is embedded in culturally defined local practices. However, without an analysis of how individuals develop identities as members of the communities of practice of which mathematics is a part, it may be difficult to readily apply these frameworks to explain how mathematics achievement is unevenly distributed across racial groups.

Taken together, these literatures have much to offer in furthering our understanding of race, culture, and learning. In this article, I extend these prior findings by drawing on the concepts of the goals that individuals construct as they participate in cultural activities and the identities that students develop concurrently. I argue that the formation of goals and identities in practice are seen as related processes that are central to learning. Specifically, I draw on findings from two recent studies of cultural practices in which some African American students construct mathematical knowledge—league basketball and dominoes—to illustrate the relation between goals, identity, and learning in practice. It is my contention that better understanding of the link between goals, identities, and learning in practice can offer important analytical tools for both understanding the learning of minority students within the cultural practice of math classrooms and thinking about how to improve such practices.

With this in mind, my goal in this article is to address the issue of race, culture, and learning in two ways. This article offers an example of the nature of mathematics learning in two out-of-school practices (dominoes and basketball) common among urban African American children and adolescents. On one level, this analysis offers a viewpoint of how successful mathematics learning is organized in these cultural practices (and how it develops), an issue of particular interest, given the poor school math achievement of the participating students. On another level, the analysis shows how relations between identity, goals, and learning play out and how analysis of these elements of practice can help us understand the dynamics of race, culture, and math learning (or the failure to learn) in any setting, including school mathematics.

In the sections that follow, I first discuss the theoretical frame and elaborate on the role of goals and identities, describing the relevance of these concepts for the study of learning. Then, I turn to an analysis of each of the two practices, describ-

ing developmental shifts and the emergence of mathematical goals and practice-related identities over time. Finally, I turn the discussion to how the issues raised by this analysis are relevant to mathematics education in general and to African American and other minority children in particular.

STRUCTURING GOALS IN PRACTICE

The perspective that human behavior is fundamentally goal directed is linked both to traditions in Soviet psychology concerned with understanding the influence of society and cultural activity on thought processes (i.e., the work of Leontiev, 1978; Luria, 1976; Vygotsky, 1934/1962, 1978) and to other early psychologists seeking to understand the developing mind in relation to social and cultural context (i.e., the work of Lewin, 1936; Stern, 1938; Werner, 1937). Because human action serves the function of accomplishing goals in the context of culturally organized activity and because these goals help structure the nature of the thought and problem solving of individuals, I find a focus on goals critical to understanding the link between cultural practices and learning.

In his seminal book, Leontiev (1978) argued for the utility of focusing on goal-directed activity as a means of understanding the intertwining of cultural, social, and cognitive processes. In his formulation, it is motives and goals that drive both cultural activity and the cognition that occurs within them. Other early psychologists also found goal-directed activity an important focus in their attempt to better understand the developing mind. For instance, Stern (1938) articulated a theory of convergence, in which the goal directedness of individual behavior was highlighted to understand both social and organizational processes in development (Kreppner, 1994). In Stern's theory, the individual acting to achieve goals offered a level of analysis that showed both nativist and environmentalist forces at work: as the individual uses organic structures and capabilities to pursue socially defined activity and objectives.

More recent accounts from the sociocultural perspective have reiterated the importance of goals as a mediating link between society, culture, and thinking (Cole, 1996; Engestrom, 1999; Saxe, 1999; Werstch, 1991). For instance, Saxe used the emergent goals framework that takes goals as a central focus and outlined various ways that cultural practices mediate the practice-linked goals constructed by children. In his view, practice-linked goals are influenced by many dynamics of activity, including social interaction between those engaged in a practice, the organizational structure of a practice, individuals' prior goals and understandings, and artifacts, norms, and conventions of the practice.

Research that focuses on school achievement (particularly motivation) has also alluded to the importance of goals as mediators for learning, although often in these formulations, goals are conceptualized as stable characteristics of individu-

als, not as dynamic and emerging in the course of social practice. In the literature on achievement motivation, individuals who primarily hold task or mastery goals (i.e., goals focused on learning) are differentiated from those who hold ego or performance goals (i.e., goals focused on looking competent or getting good grades). In these formulations, goals are seen as a fundamental influence on the amount and type learning and on the individuals' view of themselves (Dweck, 1999; Maehr & Meyer, 1997; Stipek, 1997).

Goals have also been purported to be important in understanding the school failure of some minority students. For instance, the work of Ogbu (1987) on African American students described the development of an *oppositional* frame of reference, a purposeful rejection of mainstream goals and values. This oppositional frame of reference operates to preserve the identity of students in ways that uphold the perceived or apparent community values and ideals in the African American community, particularly when school and community identities are viewed as being in conflict (Bowles & Gintis, 1976; McLeod, 1987). In these models, school failure becomes the overarching goal, giving rise to other smaller goals (i.e., to be disruptive in class, to refuse to complete assignments).

In this article, I argue that an account of the goals, both cultural and cognitive, that students construct in practice is critical to understanding how students construct and negotiate mathematical knowledge in cultural settings both in and out of school.

STRUCTURING IDENTITIES IN PRACTICE

The identities that students construct in relation to their participation in practice is a second critical component of understanding learning. Identity has been studied from a variety of theoretical perspectives, including psychology, anthropology, and sociology. In psychology, identity has tended to be conceived as an individual phenomenon, closely related to the self. *Identity* is most often defined as an amalgamation of self-concept, self-understanding, and evaluating oneself in relation to others (Markus & Wurf, 1987) and is most often assessed by survey measures. From this perspective, identity is viewed as an individual phenomenon, stable and enduring across social situations. Even from this perspective, however, identity is influenced by the social environment (i.e., ethnic identity being influenced by racial attitudes in the broader society). Nonetheless, such influences are framed with a clear distinction between one's individual identity, located inside the person, and the potential outside influences on that identity.

However, it is important to note that a growing contingent of psychologists have begun to view identity as a more dynamic construct, fundamentally tied to the social world. For example, Markus and Nurius (1986) conceptualized identity (or self) as coming about through channels of "self-ways," whereby the culture offers

paths to the self that the individual takes up. Another indication of the shifting psychological perspective on identity is a recent special issue of the *Journal of Adolescence* (Vol. 19, No. 5, October 1996) devoted entirely to the topic of identity and the social and cultural context.

The view that identity is fundamentally linked to social processes is common in sociological accounts of identity. These scholars use the term *identities* to emphasize the multiple different identities that individuals take on as they enact various roles in different social situations. For instance, Stryker (1987) viewed identity as a collection of internalized role designations, arguing that one can have as many identities as roles played within social relationships. This conceptualization of identity as being linked to roles in social interactions and practices was also put forth by Wiley and Alexander (1987). They wrote, "social action always produces situated identities, conceived of as dispositional activities, settings, roles, and the self" (p. 110). Although these theories weigh heavily on the social determinants of identity, they do not preclude identity as having an internal component.

Anthropologists have also been concerned with how identities play out in social and cultural worlds. In anthropological studies of identity, the focus has been on how developing identities are fundamentally tied to human activity, affiliation, and meaning systems (Holland, Lachiotte, Skinner, & Cain, 1998; Mead, 1934). In their recent anthropological exploration of identity, Holland et al. explored the development of identities in several cultural worlds among adults and children and showed how identities develop in relation to "figured worlds," in which identities come to embody cultural meaning systems. However, although they argued that identity construction is a cultural and social process, they also viewed it as a process in which the individual also expresses considerable agency.

In research on the learning of minority students, the relation between identity and schooling has long been viewed as critical. One early example of this argument occurred in the work of Clark and Clark (1950). They conducted a series of identity experiments in which Black children were offered a choice between Black dolls and White dolls. Their choice of dolls was taken to be a measure of their identity and self-esteem. Results showed that Black children overwhelmingly chose White dolls over Black dolls, which Clark and Clark interpreted to mean that these students (all of whom attended segregated schools) suffered from a damaged sense of themselves as a result of segregation. The consequences of this work for the learning and schooling of African American children was profound. Not only is this a widely cited study, but Kenneth Clark (describing these findings) was a key witness (on the side of desegregation) in the *Brown v. Board of Education* (1954) trial of the early 1950s. His core argument was that segregated schooling offered African American children an inferior education partially through its effect on their identity (Kluger, 1977).

Ogbu's work (cited in the previous section of this article) also supported the critical role of identity in students' learning. Fordham and Ogbu (and others) argued that under certain conditions, minority students disidentify with school, re-

sulting in school failure (Fordham & Ogbu, 1986; Graham, Taylor, & Hudley, 1998; Osbourne, 1997). Recent research has also shown that when students are encouraged through consistent instructional practices to build strong identities with school, learning and achievement are enhanced (Mehan, Hubbard, & Villanueva, 1994). Other research on the learning of minority students has also implied that identity is important to the learning process. Scholars have argued that children's cultural knowledge is one of the resources teachers draw on in instruction to increase engagement and learning (Delpit, 1995; Ladson-Billings, 1995, 1997; Lee, 1995a, 1995b). For instance, Ladson-Billings (1995) described *culturally relevant pedagogy* as teaching that fundamentally respects the intelligence and real-life experiences of children, that apprentices students to a learning community, and that engages children in a constant struggle against the status quo. Ladson-Billings (1995) reported that successful teachers of minority children often engage in these practices. Like that of Mehan et al., this research supports the idea that good teaching practices help students connect their existing cultural identity with their experiences in the classroom.

In addressing issues of identity in this article, I take a sociocultural perspective and view identity as being constructed by individuals as they actively participate in cultural activities. Drawing heavily on the work of Wenger (1998) and Holland et al. (1998), in which identity was elaborated from a perspective that focused on individuals in the course of everyday cultural activity, I view identity as a fluid construct, one that both shapes and is shaped by the social context. Indeed, identity is not purely an individual's property, nor can it be completely attributed to social settings. From Wenger's perspective, identity develops both through individual agency and through social practice. Further, the development of identity, or the process of identification, is linked to learning, in that learning is about becoming as well as knowing. It is my view that this issue of how learning settings afford ways of becoming or not becoming something or someone is central to understanding culture, race, and learning, particularly given the multiple ways that race (and social class) can influence both the kinds of practices within which one can become and the trajectories available in those practices.

Wenger (1998) argued that three modes of belonging characterize how identities are constructed within communities of practice. He termed these modes *engagement*, *imagination*, and *alignment*. Engagement refers to how one participates in a community of practice. Imagination refers to how one sees oneself as being connected to a broader community of doers, and alignment refers to how actions within that community come to be aligned toward a broader common purpose. It should be noted that this theoretical approach acknowledges both participation and nonparticipation as possibilities, with combinations defining different and less central ways of participating, such as marginality or peripherality.

Wenger (1998) also clarified that the process of identity development is comprised of both identification and negotiability. *Identification* is "the process by

which modes of belonging become constitutive of our identities by creating bonds or distinctions in which we become invested” (p. 191). In other words, identification describes the process of identity construction through becoming a member of a community of practice. *Negotiability*, on the other hand, refers to “the ability, facility, and legitimacy to contribute to, take responsibility for, and shape the meanings that matter within a social configuration” (p. 197). Hence, negotiability implies an additional kind of ownership and agency that acknowledges the mutual constitution of individuals and social practices. Together, identification and negotiability allow for both social structure and agency. However, they do not, by themselves, allow us to account for developmental shifts in identities in social practice. In this article, I take developmental concerns to heart, drawing on the Vygotskian notion that to truly understand something, one needs to understand its developmental course, as knowledge of the developmental process offers indications of the true nature of a phenomenon.

In the following sections, I describe the practices of dominoes and league basketball among African American students, exploring how mathematical thinking develops in the context of these practices and attempting to understand the relation between the nature of students’ mathematical thinking and their shifting goals and identities within these cultural practices. First, I focus on the practice of dominoes and the way the nature of engagement shifts in ways that have implications for identity and for learning.

IDENTITIES AND GOALS IN DOMINOES

The data reported in this section are from a study of African American elementary school, high school, and adult domino players and the developing strategies they constructed as they learned to play the game of dominoes (Nasir, 2000a). This study included both qualitative and quantitative research techniques. I observed players at three age levels over the course of a week-long tournament (in this article, I focus on two of these groups: elementary school and high school students). I also interviewed individual players and asked them to solve “standardized” domino tasks. In the following sections, I offer a brief description of the game; then, I focus on the differences in players’ emergent game goals (including mathematical goals) from elementary school to high school. Finally, I take up the concern of players’ identities and the nature of the affordances for identity shifts as players moved from lower to higher levels of play.

The Game of Dominoes

The materials used in domino play consist of 28 tiles, as depicted in Figure 1. Each tile is separated into two halves and on each half is a number (represented by dots)

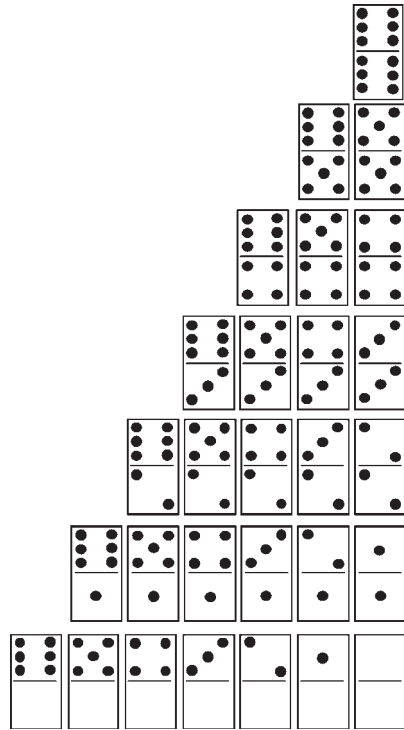


FIGURE 1 The full domino set.

from 0 to 6. The full set includes every possible combination of numbers from 0 to 6, including doubles. A game begins with each player drawing seven dominoes from the entire set that has been randomly arranged face down on a table.

The first hand begins with the person who has drawn the double 6 playing first. The game has a turn-taking structure in which players must match the end of a domino from their hand with an end square on the table. If the play results in a sum of all end dominoes as a multiple of 5, the player receives those points. If the sum is not a multiple of 5, no points are made.

For example, Figure 2 depicts the first four plays of a domino game. In the first play a player begins with the 6–6. The next player follows with the 6–2, resulting in the total number of dots on the ends being 14 ($6 + 6 + 2 = 14$), which is not a multiple of 5 and hence not a score; so no points are made. The third player plays the 6–3 on the 6–6, resulting in a total of 5 end dots ($2 + 3$), which is a score of 5 points. The fourth player follows up by playing the 3–3 on the 6–3, resulting in the total number of end dots being 8 ($2 + 3 + 3$), which does not produce a score.

Pairs of individuals play in teams against one another, and ideally, players work to both block the opposing team from scoring and assist their partner in scoring. As players are engaged in the play of the game, they make many types of decisions,

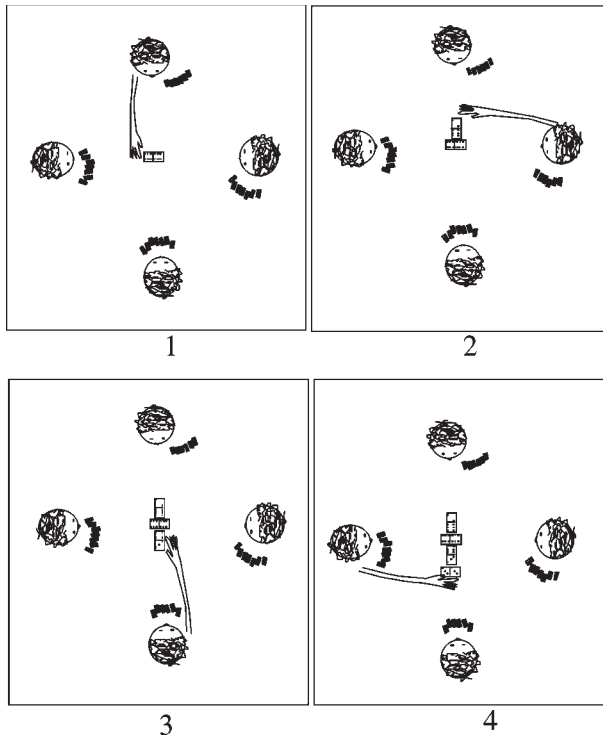


FIGURE 2 A sequence of domino plays.

from choosing an opening play from their seven initial tiles to playing in the hopes of scoring points and winning games.

Although dominoes is deceptively simple on the surface, the strategies of sophisticated domino play can be quite complex. In fact, it is partially due to the wide array of potential game goals and complexity in game strategies that the game holds appeal for players from as young as 6 or 7 years old to adults well into their senior years. Expert players recognize the great skill, experience, and planning it takes to play this game well. Players must learn to coordinate mathematical additive and multiplicative understandings with complex game goals, such as scoring, blocking opponents from scoring, assisting one's partner, and simultaneously participating in lively dialogue.¹

¹This complex logical and mathematical thinking in the context of game play has also been found in studies of other strategic board games, such as chess (Charness, 1991; Chase & Simon, 1973a, 1973b; DeGroot, 1965) and Treasure Hunt (Saxe & Bermudez, 1994; Saxe & Guberman, 1998a, 1998b), in which children can also gain valuable experience with numbers, quantities, order, and strategies.

Due to the many potential levels of complexity that domino play can take on, it is perhaps not surprising that the play of elementary school players is qualitatively different from that of high school players (Nasir, 2000a, 2001). These differences include contrasts in the pace and flow of the game, as well as differences in the types of plays structured by players. Other changes from elementary school play to high school play include shifts in the prevalent ways of talking and interacting in game play and different norms and ways of structuring help (Nasir, 2000a; Nasir & Peele, 2001). The changes in the nature of play are reflected in the goals players structure in practice and the identities they construct.

Goals in Dominoes

My immediate focus in this article is on the mathematical goals that players' structure in game play. However, for both dominoes and basketball (and indeed, many other activities), these mathematical goals are embedded in (and arise in relation to) broader *practice-linked goals*.²

Practice-linked goals. Many elementary school players were novices and were just becoming familiar with the game rules and the flow of play. Hence, a major concern for elementary school domino players was that of simply creating a play when it is his or her turn. This goal of sustaining play was evident in the following play by David:

David and Tyrell were partners. On his turn, David pretended that he could not reach the board to enlist his partner's help. He held out the 6-0 from his hand and said to Tyrell, "Man, put that down there, dog," handing him the domino as if the proper placement of it was too far for him to reach. An opponent [perhaps onto his game] asked, "Where?" Tyrell said, "It goes right there!" indicating the end closest to David. Tyrell then placed the domino on the 6-6 [the end closest to David] for him.

In this play, David chose the appropriate domino, the 6-0, but was unsure of where it should have been played. He tried to camouflage his uncertainty by pretending that he could not reach the other side. He clearly wanted to sustain play but did not realize the essential function of making a match to accomplish this goal. Because he did not seem to know what was involved in making a match, he had trouble coordinating the dominoes in his hand and the game board to sustain play, despite the fact that he chose a plausible play from his hand. Due to this lack of coordination between his hand and the board and between his goal and his knowl-

²Although I recognize that indeed, all goals are linked to some cultural practice, I use this term (borrowing from Saxe, 1999) to refer to the broader goals of activity.

edge, he had to develop an alternative means to make a play; so he pretended not to be able to reach the board to elicit assistance from his partner.

This concern with maintaining the flow of play and being able to complete one's turn tended to characterize the play of elementary school players (Nasir, 2000a, 2001; Nasir & Stone, 2001). It was evident in plays like the one depicted here, where the player had trouble coordinating the game forms to sustain play, and in slightly more sophisticated plays, where the player successfully completed a play turn without assistance. In addition to sustaining play, the most sophisticated players at this level were also concerned with preliminary scoring; that is, they knew that scoring was one of the game goals that they wanted to work toward, but they did not have a clear sense of how to create a score or how to recognize one (Nasir, 2000a, 2001).

In contrast, high school players took the goal of sustaining play as a given; there was not the concern that the game could break down due to players not being able to complete a play turn. At this level, scoring was the primary goal, reflecting an emerging concern with more complex game functions (Nasir, 2000a). Consider the following excerpt from high school domino play. The following sequence of plays and comments revealed both the focus on scoring and a concern for more complex game goals (e.g., blocking):

James and Aaron were playing against Reginald and Carter. Reginald had just played the 5–6, scoring 15 points. It was James's turn. He commented, "Way too much money on the board" (see Figure 3).

In the first play, Reginald played the 5–6, resulting in a score of 15 points. To create this score, players like Reginald reported surveying all of the possible plays in their hands, mentally trying out each one, and calculating what the final point count would be for each play. The score of 15 points with the 5–6 was the highest possible score he could make; hence, he made the score and called his points.

In his comment, James revealed his concern with the amount of "money," or points on the board. It might not be obvious why this was of particular concern for James or how this statement implied a consideration of blocking in addition to scoring. After all, if the point of the game is to score as many points as possible, having more possibilities to score high would be desirable. However, James knew that to win, you must block opponents from scoring as well as score points your-

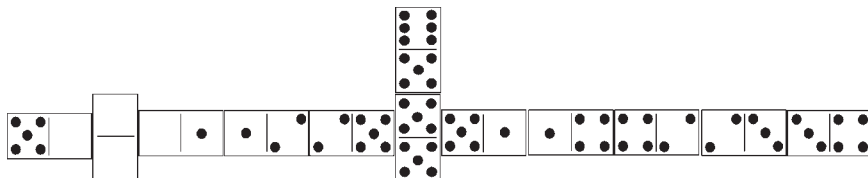


FIGURE 3 James's comment on Reginald's play.

self. If there are a lot of points on the board, there are more possibilities for your opponents to score, and this makes it harder for one to block scoring possibilities. On this play, James played so as to reduce the total amount of points on the board to minimize the chance of his opponents scoring (or at least scoring a lot of points). His play, therefore, illustrates that it is not only important to be concerned with scoring (i.e., playing so as to create a multiple of 5 in the sum of the end pieces), but it is also important to balance that goal with other important game goals, such as blocking³ an opponent from scoring. This balance is critical to success in the game. If a player simply scores points every time they can, they may lose as many points as they gain. In contrast, players who both block and score gain a significant advantage over their opponents.

Skill at blocking entails considerable knowledge, some game specific and some more general. To block, a player must have a good sense of the pieces that constitute a full set of dominoes, which dominoes have been played (by whom), and which dominoes are yet to be played and may be in their opponents hand. Further, a player must be able to ascertain which of those unplayed dominoes could be a source of points for their opponent on a particular play and be able to play so as to prevent these potential scores. These shifts in practice-linked goals and game strategies as players move from elementary school to high school play have implications for the mathematics goals that players structure in the game. These goals involve additive and multiplicative relations as well as conceptual probability and logic.

Mathematical goals. In practices such as dominoes, mathematical goals arise in the context of activity, when mathematical operations become a normal and required part of the cultural practice (Nasir, 2000a). Consider the mathematical thinking necessary for an elementary school player to make a play. In the initial example that I presented, the mathematical goal David faced was fairly simple: He needed to be able to match numbers such that two representations of the same quantity were played end to end. To achieve this goal, David needed to be able to recognize number representations (in the form of dots) and identify matches between the dominoes in his hand and those on the table.

In the example from high school, both Reginald and James constructed mathematical goals that were very different from the goals that David attempted to achieve. Reginald was concerned with calculating the potential score, given a hypothetical play. This involved not just counting those dots on dominoes in front of him but also subtracting the dots that would be covered by the play and imagining what would be removed and what would be added. This problem was made more difficult by the game rule that prohibits making a play and then changing it; so physical manipulation of the board to make choices clearly was not a possibility.

³Some ways to block include making plays that opponents cannot play on or causing players to pass.

In addition to the mathematical thought involved in creating a score, James was concerned with blocking his opponents from scoring. This strategic goal necessitates additional mathematical and logical thought processes. For instance, it requires knowledge of the full domino set and a mechanism for counting what has been played and what has not been played. Further, it involves the use of an understanding of the combinations that result in a multiple of 5. Finally, such a strategy involves a significant amount of hypothetical reasoning, and player must be able to compare and make judgments about potentially gained points versus potentially lost points (e.g., “If I play this, he could play that”).

One example of such if-then reasoning can be found in a high school player’s response to an interview question regarding the best possible play in a given game situation. The player was shown a mock domino board and hand and was asked to talk through his play choice and his reason for the choice. In the following transcript, it becomes clear that the player considered both his own play possibilities and the multiple possible outcomes from those plays:

Player: If I go [play] 0–1, I would get 15 [points] that way, but that’s what I’m sayin’, the man is going to call 25 behind me [i.e., my opponent will score 25 points].

Interviewer: How would he call 25 behind you?

Player: Well, either 25 or 20, with either 0–5 ... [pause] ... and it would be outrageous because everyone is going to call money around the board, and it would get back to me, and I won’t have anything to call money with. So you don’t want to do that. If you call money like that, where it will go around and be a domino effect, you always want to make it so you’ll have something to keep it going. You don’t want to be the man lost out. If you call 15, he’s going to call 20, and it’ll get back to me, and I’m going to be stuck with nothing. So you always want to have it so you’ll get the highest out of the situation.

In this example, the player articulated his thought process when deciding to make a particular play. He thought not only about his own play and that immediately following his but also about how that play could affect the flow of pieces and his subsequent opportunities to score.

In another example, a player illustrated a kind of informal probabilistic reasoning as he described his view of a good domino player:

Interviewer: What makes a good domino player?

Player: You have to be able to count, strategize. You got to be able to read what opponents and your partners’ doin’ by they plays.

Interviewer: How do you do that?

Player: That's what I'm sayin'. If you have a lot of somethin', of one suit, you gon' to try to put them out there—where nobody else will be able to play but you, so that's one way to read it. Another way is if a person doesn't have anything, he's going to run scared from certain numbers. Like try to cover them up as they get out there. ... You cover up what you don't have with the little ones that you do have. The one you got a lot of you try to put that out there in different strategy positions, so people can't cover them up. That's why its always good if you have a lot of one thing and you have the double, for it to be your spinner, so you can have the four sides to play on. So that's more possible plays for you.

In this description, the player argued that a good domino player “reads” the board. That is, a good player keeps track of how many of the seven of each suit have already been played and who has played them where and uses that knowledge to guide their own play. Specifically, he described strategies in which players who have very few of a given suit “cover” it on the game board and where players with several dominoes of a suit play it in key places to maximize the probability that they will be able to play later in the game.

Overall, this analysis showed that the nature of players' goals (practice linked and mathematical) shifted with increasing levels of play. Elementary school players were primarily concerned with sustaining play and matching numbers. High school players took on the goal of scoring, including the mathematical goal of determining the possibility of the score before the play. Further, high school players began to weigh scoring goals with other goals, such as blocking, which led to the use of other kinds of mathematical and logical knowledge.

This shifting of goals, both practice linked and mathematical, was a consequence of game experience in dominoes and an increasing familiarity with the game, but they also point to the way increasing knowledge is linked to new ways of participating in the game of dominoes. Learning in the game, then, can (in part) be described as developing new goals, both practice linked and mathematical, and new knowledge for participating in the practice of dominoes (see Table 1).

TABLE 1
Goals in Dominoes

	<i>Practice-Linked Goals</i>	<i>Mathematical Goals</i>
Elementary school	Sustaining game play Making a play	Matching like numbers Adding and counting
High school	Scoring points Blocking	Creating multiples of 5 Hypothetical and deductive reasoning

Identity in Dominoes

Not only did players' practice-linked and mathematical goals change as they moved from elementary school to high school domino play, but there was also a concomitant shift in players' identities (as indexed by their engagement) over time. Both the shifts in goals and the shifts in identities were related to the emergence of new ways of participating in practice. This shift in identity was rooted in the changing nature of engagement. In the following section, I illustrate how the nature of engagement shifted in dominoes as players learned the game and offer evidence to clarify that these shifts in engagement involved simultaneous shifts in identity.

Mutual engagement is a core principle of sustaining practices. It is through being involved with activity in concert with others and as a part of a broader system of activity that practices and communities take shape and individuals learn and develop (Wenger, 1998). Learning, then, involves coming to new ways of engaging in practice. As the character of participants' engagement shifts, so does the nature of the practice itself.

As illustrated in the previous section, elementary school domino play differs from high school play in the goals that play affords and that players take up. Observation of play at both levels also revealed a difference in the flow and energy of the game. High school play was more intense, more energetic, more emphatic, and quicker in pace (Nasir, 2000a). Talk became more integrated into game play and more elaborated (Nasir & Peele, 2001). These differences in the character of play were a product of the skills and knowledge players brought to the game and also reflected differences in players' engagement.

Differences in engagement at the two levels of play were consistent, if subtle. High school players showed greater attention toward the game, and their growing cache of prior knowledge allowed them to begin to attend to multiple purposes and happenings at once. Engagement was also reflected in the extent to which players brought discussion of nongame events into the domino games. At the high school level (and this was even more pronounced in adult play), players' conversation flowed from game to nongame topics fluidly, thereby constituting the game context as a personal space with many purposes (Nasir, 2000a; Nasir & Peele, 2001).

Differences in engagement could also be found in the nature of the relationships between players. In high school play, intense mutual engagement was reflected in the way that players developed relationships with one another in the context of the practice (Nasir, 2000a). Over the course of play, teammates and opponents developed a respect (or disrespect) for one another's play skills; they came to be able to expect a certain kind of play from one another and to respond to those expectations with jokes, teasing, and laughter. In the context of the game, players were regarded by virtue of their playing experience and skill, an identity that at least during game time, transcended their identity outside of play.

In contrast, in elementary school play, players tailored their interactions with one another to the nature of their relationship in school, outside of the game (Nasir, 2000a). Friends outside of the game were friendly with one another during play, and class bullies were accorded more respect during the game. For example, in an elementary school game, players consistently deferred to a player who held a large amount of power and authority outside of the game context. Elementary school players carried their relationships from other practices into their domino games, both reflecting and contributing to the less intense, less invested quality of engagement found in their games. In contrast, high school players developed practice-specific relationships, reflecting a more intense mutual engagement that was based on a shared history specific to the practice.

Identity is also shaped through an accumulation of a shared history of experiences among players. In dominoes, this shared history is both a history that is common across domino games and across playing communities (i.e., repeated patterns of play, frequency of common scoring combinations, ways of interacting, ways of scoring, sequences of play) and a history that is specific to particular playing communities (i.e., expectations of playing habits of individual players, characteristics of players, expectations regarding skill level and interaction style; Nasir, 2000a). These accumulations of shared experience may contribute to a qualitative difference in the identity that players construct in the practice between elementary and high school players.

For elementary school players, there was little shared experience in either general (across community) characteristics or community-specific patterns. Because these players were novices at game play, they were just beginning to build these shared histories in the context of the game. However, high school players in this study had developed a significant pool of across-community shared history with other players. Because the game of dominoes has a strong and pervasive set of behavioral and interactional norms associated with it, players had developed a common base of expectations and experience that contributed to the nature of their mutual engagement. This common base or shared history also contributed to the familiar cultural style of interaction and the colorful way that players verbally negotiated the play of the game. This shared history also helped to build a common and coherent working definition of what constituted competent play. With this definition in hand and with a broad vision of a play trajectory that this definition fostered, high school players restructured their game goals and their identity as players.

In activity, engagement ties individuals to practices in complex ways. We have seen in this analysis how the concept of engagement as a critical part of identity helps us link ways of participating to goals, identity, and mathematical learning. However, a focus solely on engagement as a mode of belonging, although offering a grounded description of what changing identity looks like in practice, does not speak to how these changes in identity are linked to changes in how participants

construct their notion of self in relation to their practices. To address these issues, I turn to goals and identity in the practice of basketball. In doing so, I discuss Wenger's (1998) two additional modes of belonging, namely, imagination and alignment, and I explore how all three modes of belonging intertwine and play out as players become more expert at the practice of basketball.

IDENTITIES AND GOALS IN BASKETBALL

The data presented in this section are from a study of middle school and high school African American male basketball players (Nasir, 1996, 2000b). The focus of this research was on documenting how basketball (specifically, the use of statistics⁴ in evaluating the quality of play) led players to construct mathematical goals as a part of their practice. The study used ethnographic techniques, focused interviews, and mathematics tasks (in two formats: basketball problems and school problems) to understand the mathematical knowledge players constructed, how that knowledge shifted with age, and the relation between practice participation and knowledge construction.

In previous analyses (see Nasir, 1996, 2000b), I explored how the practice of basketball affords different levels of engagement in statistical thinking and reasoning and pointed to key differences in the statistical thinking of middle school and high school players. I also compared the practice of basketball and the practice of school, exploring the way success in each of these environments is afforded by the players' social reality and the nature of their practice (Nasir, 1999, 2000b).

In keeping with my purpose of highlighting the importance of goals and identities and their interaction in understanding learning, I first situate the analysis in the experience of basketball play. I then discuss the importance of goals in understanding the shifting nature of mathematical understandings in play (as players moved from middle school to high school play). Finally, I explore the critical role of identity (as gauged by engagement, alignment, and imagination) as a mediator of learning.

The Practice of Basketball

Like any practice, the practice of basketball has many components. There is the actual game play: the crowded gymnasium, friends and family cheering, band playing—an immersion in sound and movement. Adrenaline rushes as the player dribbles the ball up court, looking for a space between opponents to pass or drive to the basket. Then, there are the more mundane aspects of play: the daily practices,

⁴Here and throughout this article, I use the term *statistics* interchangeably with the term *stats*.

where drills are repeated until plays and moves are carried out with perfection; where players are corrected, cajoled, and screamed at; and where tempers occasionally flare and laughter is interspersed with intense concentration. There is also the informal time when players congregate before and after games or practices to talk, to check their “numbers,” to shoot around, and to compare their own play to that of professional and college players. It is in this space that statistics become integral to the practice.

In basketball, statistics are one means by which players evaluate performance. Numbers, such as percentages of shots made from the free-throw line or the average number of points scored per game, offer an objective means by which players can be compared. However, these quantitative measures, although informative, are weighted with qualitative judgments as well. One player summed up the balance nicely:

Oh, they're [statistics] important, but they're not, see, you can't ever really see how good the player is unless you come and see him yourself. You can see somebody's statistics and maybe they average 20 points, and they have five rebounds and five assists and you go see them, and they might do that, yeah, but they might be playing some little wack team that don't really matter anyway. (as cited in Nasir, 1996, p. 24)

As this description illustrates, players not only learn facility with calculating and interpreting statistical measures, they also come to learn how to balance these statistics with other more qualitative measures.

Goals in Basketball

In basketball, the goals with which players approach the game and the goals that they structure and restructure in play are critical in understanding the nature of the mathematical learning that occurs. This analysis explores goals at two levels: goals linked to the practice of basketball and the use of statistics generally and goals linked to mathematical problem solving more specifically. As players moved from middle school to high school play, both of these types of goals shifted in nature, resulting in a concomitant shift in the kinds of mathematical knowledge that students developed. As in the discussion of dominoes, I conceptualize goals as being a unit of analysis that incorporates both the way in which goals are afforded by the setting and how individual players take up or appropriate these goals.

Practice-linked goals. One indication of how goals shifted from middle school to high school play was revealed in observations of the purposes for which players engaged in the practice. For many middle school players, play in basketball could serve varying purposes. Some played because the basketball program kept them for an extra 2 hr after school, crucial hours between the end

of the school day and the end of the work day when their parents could rest assured that they were safe. Others played because basketball was just one of many sports they participated in; for example, one student reported that his favorite sport was football, but he played the sport currently in season, which during the winter happened to be basketball. Other players had a special commitment to basketball.

In contrast, high school players were uniformly highly committed to the sport of basketball. For them, the purpose of play was more than simply a fun pastime; for them, basketball was a central part of a long-term life trajectory. In fact, the majority of high school students said that they saw themselves going on to at least college basketball and possibly professional basketball (Nasir, 1996).

These goals were not simply individual constructions created by players out of thin air. The goals that players purported at both middle school and high school levels were afforded by the structure of the practice of basketball at these two levels (Nasir, 2000b). For example, high school basketball practice was structured in such a way that the stakes for winning and losing games were high, and a player's individual stats profile was of great importance. At the middle school level, there were few, if any, consequences for a losing record or poor individual play. Differences also existed in the artifacts that became a part of play at the two levels (i.e., a sophisticated scoreboard at the high school level and no public scoring record in middle school games; Nasir, 2000b).

These differences in the purposes of play were related to differences to the extent to which and the way in which players utilized statistics as a means of evaluation (Nasir, 1996, 2000b). For players at both levels, both quantitative (e.g., statistics) and qualitative evaluations were important to get a feel for the strengths and weaknesses of a player. Where middle school and high school players differed was in the way that they used quantitative evaluation and the goal toward which they employed it. Middle school players used quantitative evaluation to compare their own play to that of their peers or to compare the play of one professional (or college) player with that of another. These comparisons tended to take place in relation to statistics that involved counts (i.e., number of points scored).

At times, high school players utilized statistical information for similar purposes, but in addition, they used statistics to compare themselves to a norm or standard (a statistical profile) for the position that they played. They also discussed statistics in the context of talk about how recruiters and coaches might evaluate a players' numbers, both to compare across players and situations and to compare players to a standard for a particular playing level or position. In doing so, they relied on statistical measures that involved proportional relations and counts, including averages and percentages. For example, one often-cited statistic was points scored per shots taken, both from the free-throw line and from the field.

High school players were also more regularly involved in calculating their own statistics for monitoring and comparing purposes. One player described his engagement with statistics as follows:

Sometimes, like, if I score, or if I make a free throw, I kind of keep up with what I'm doing in my mind, making mistakes. Keep everything, my scores, my free-throws, keep up with what's happening. Sometimes it'll get off, like in the heat of the battle you'll kind of forget about it, and at the end of the game you look on the paper. (Dwayne, personal communication, February 1996)

Here, the player described his efforts during game play to keep track of his statistics and his reliance on the official statistics records in case he made an error. His efforts convey the important place statistics knowledge had for him and his attention to the numbers even in the heat of play.

Once again, it is important to point out the fact that these constructions by players regarding the importance of statistics in their play were fundamentally afforded by the nature of their practices at the two levels.

Mathematical goals. These differences in practice-linked goals were related to differences in mathematical problem-solving goals for players. To illustrate these differences, I draw on players' answers to the basketball-format mathematics questions. Consider the following players both solving this problem:

You are at the free-throw line. You take five shots and make 2 of them. What is your percentage from the line?

A middle school player, Anthony, answered that the free-throw percentage was 10%. He explained, "I multiplied 2 times 5 and got 10. That's an easy number." This answer was very typical of middle school players, who by and large, performed operations on the numbers without much regard to the nature of the problem. In contrast, many high school players solved this problem like David, who explained, "It would be about 40%. It didn't make half, so it wouldn't be over 50%" (personal communication, April 1996). David used his knowledge of a common percentage, half, to reason about the probable percentage of 2 shots out of 5.

These solutions reveal different mathematical goals, with middle school players seemingly having the goals to produce a mathematical answer using the numbers in the problem. High school players' goals were more grounded in their practice; they seemed to want to find a solution that made sense in the context of the basketball scenario. High school players engaged mathematical problems as a normal part of their practice, hence they accomplished the solutions to basketball math problems by using statistical information practically. High school players also had

knowledge about the way stats were expressed and interpreted, their normal context of usage, and normal statistics for a player, given their position (e.g., guard or forward; Nasir, 2000b).

Middle school players did not have the same kind of practical experience with complex statistics; so although they were exposed to these statistics, they did not use them in their everyday practice to the same extent, and they rarely, if ever, had occasion to calculate their own statistics (Nasir, 1996, 2000b). Further, they did not have a basketball framework with which they could make sense of the problems; so they linked the questions to their knowledge of school-type problems, in which answers are sought by carrying out a calculation with the numbers in the problem statement.

Identity in Basketball

Just as goals were constructed by players in the course of their play, so too did players' identities emerge as a product of their participation in basketball. Coming to identify themselves as "ballers" in line with basketball players all across the country was one way that young basketball players' lives changed through their participation in the sport. In this section, I discuss the shifts from middle school to high school play, organizing my discussion in terms of Wenger's (1998) three modes of belonging.

Engagement. In basketball, players' level of engagement was a defining aspect of their practice. High school players were deeply engaged in the practice of basketball. As illustrated in the section on emergent goals, high school players took their participation in basketball seriously. This engagement was manifested in players' dedication to winning, the relentless practice of their skills, and the professional manner with which they approached games and practices. In contrast, middle school players were not as intensely engaged in the sport. For them, as discussed in the previous section, basketball was an interesting and fun pastime, and their casual approach to practices and games was indicative of their level of engagement (Nasir, 1996, 2000b).

The nature of players' engagement was also evident in the way that players interacted with one another and the nature of the relationships they built. Both groups of players learned to play with one another as teammates during the course of the season. In both groups, players made special friendships among other team members. However, the deeper engagement at the high school level was reflected in the fact that team members seemed to develop a particular bond with other players in the course of their practice. They came to know and trust one another on the court, anticipating certain plays and particular styles of play and knowing when to expect a pass or a long shot from the field. This on-the-court relationship both helped structure and reflected high school players' engagement in their practice.

On the other hand, middle school players' relationships with one another were substantive but not specific to knowledge of each other in the practice of basketball (Nasir, 1996, 2000b).

Another component of engagement is the way members of communities of practice draw on their accumulation of shared history to project common trajectories within the practice. The intensity of play and the large amount of time spent as a team led to the building of a base of shared experiences among high school players; these experiences fostered strong identification as basketball players came to see basketball as a substantial part of their future. As they built team memories together, each players' role on the team became a routine, a standard part of the practice, and the players came to change the way they saw themselves vis-à-vis their place on the team. As their physical talent improved with practice, they saw themselves as more expert players. Hence, engagement influenced identity, and identity influenced engagement in an iterative process, carried out over a developmental trajectory within a cultural practice.

Imagination. Wenger (1998) described the role of imagination in the construction of identity as "the ability to dislocate participation ... in order to reinvent ourselves, our enterprises, our practices, and our communities. Imagination requires an opening, the energy to explore new identities, and new relations" (p. 185). Hence, imagination involves developing understandings and possibilities beyond the present state. It includes defining a trajectory that connects what we are doing to an extended identity and seeing ourselves in new ways. It involves finding meaning across settings and time. Imagination requires the ability to explore other ways of doing things, generating scenarios and other possible worlds. In the case of basketball, high school players' evolving engagement was related to the way the differing nature of their practice afforded their perception of their community and their place in it. In contrast, the practice of middle school players and their engagement in that practice neither emphasized nor fostered players' connections with communities of basketball practice beyond their own.

High school players, in accord with their ideas about their basketball trajectories, imagined themselves (with the support of their coaches) as a part of a larger community of basketball players, both within the school and in other settings, including a sense of connection with players on other teams. For instance, although both middle school and high school players knew the rankings of college and professional players well and kept abreast of game outcomes, high school players were more likely than middle school players in interviews to mention players from their neighborhood that went on to play professional or college ball as their favorite players (Nasir, 1999). This recognition of those who have gone before them demonstrates an imagined connection to the sport via these other players. This sense of place (and life trajectory) within a broader system fostered high school players' identities as basketball players. All but one high school player saw them-

selves as going on to play basketball in college, and many articulated that basketball was one way to get to college despite limited funds.

The data indicate that imagination is both a product and a consequence of greater engagement; with increasing engagement, the extent to which players saw their own play as situated in a broader community of players also increased. This more elaborated imaginary connection further motivated engagement.

Alignment. Another important component of developing identities in communities of practice is alignment. Alignment is a process of translating imagination into action and involves “the ability to coordinate perspectives and actions in order to direct energies to a common purpose” (Wenger, 1998, p. 186). In practice, alignment is the coordination of action across communities of practice. This coordination of action both reflects and constitutes identity: As participants in one community align their actions with participants in other communities, the nature of their participation changes.

In basketball, alignment became a part of identity when players drew on their imagination about their futures in other communities of basketball practice to structure their actions in the present. In other words, it was, in part, because of their intended future in higher levels of basketball play that players aligned their daily actions with those of college and professional players. This alignment occurred to some degree in both middle school and high school play; both sets of players read basketball magazines and kept track of the outcomes of professional and college games. Similarly, both sets of players watched basketball games on television and kept track of major trades and playoff finalists (Nasir, 2000b).

However, as the level of engagement and imagination varied from middle school to high school, so did the level of alignment. Although both sets of players aligned their actions with the broader basketball community through practices such as keeping abreast of basketball news, they differed with respect to how they aligned their actions in the play of the sport itself. High school players (but rarely middle school players) discussed their attempts to emulate the play of the professionals that they respected, thereby aligning their play style and choices during play with the professional players that they hoped to emulate (Nasir, 1996).

The high school coach also took part in some alignment work among the players by helping them to align their actions with those of an ideal of a student athlete. Alignment also took place in more mundane ways as players wore basketball clothes and shoes that identified them as ballers to the rest of the school community. One extreme example of this was the call by certain shoe companies that players not only align their athletic shoes with the practice standard, but that the players themselves help to create this standard. In this role, high school players chose shoe styles and story boards and made recommendations about potential celebrity endorsers for an athletic gear company (Nasir, 1999).

GOALS AND IDENTITY IN PRACTICE

The previous analysis shows how goals were structured in alignment with the identities players' structure in practice and, conversely, how the structuring and accomplishment of new goals in practice constituted a shift in identity. This mutual process was evident in both the description of dominoes and that of basketball. As domino players took on new (and more sophisticated) practice-linked and mathematical goals in the course of their play, they also became more engaged in the practice of dominoes. In the practice of basketball, as players moved from middle school to high school play, they became engaged in the practice in increasingly intense ways: They took the sport more seriously, they easily imagined their own connection to a broader basketball community, and they aligned their actions in play with players at higher levels. This process of increasing their identities as ballers co-occurred with shifts in players' practice-linked and mathematical goals.

These shifts in goals and identities were also associated with changes in mathematical learning. In dominoes, players shifted from basic matching numbers and addition at the elementary school level to complex inferences of probability and logical (if-then) thinking at the high school level. In basketball, players' mathematical goals shifted from understanding basic statistics involving counts in middle school to calculating relatively complex statistics with percentages and averages in high school.

In many ways, the treatment of goals, identity, and learning presented in this article offer a coalescence and reiteration of what we have learned as a field from sociocultural accounts of learning. The data presented highlight the idea that mathematics in everyday practices is embedded in the context of meaningful activity. In part, this meaning is derived as individuals become members of a community of practice. Further, cultural practices structure the nature of the mathematics (via the goals players construct and the activity affords) in fundamental ways.

However, the data presented in this article also suggest new insights. To date, sociocultural accounts of learning have offered good descriptions of how individuals move through cultural practices that are fairly stable in nature, that is, how newcomers come into established practices of "old-timers" and come to be increasingly substantial participants (and learners) in these activities (Cain, 1991; Lave, 1988; Lave & Wenger, 1991; Rogoff, 1990). However, the data on dominoes and basketball show us that, indeed, the nature of the practices themselves may shift in relation to the expertise of the participants. In fact, one important contribution of this work is the potential for gaining a better understanding of learning in cultural practices from a developmental perspective. The research presented in this article makes clear that development occurs both at an individual level and at the level of the practice itself. In fact, in basketball and dominoes, as in many other practices, the skills and developmental levels of the players were inextricably linked to the

way the activity was carried out among those players. In other words, the individual within the practice developed, as did the practices themselves.

Basketball and dominoes differ from practices where individuals are apprenticed or scaffolded into full participation by gradually taking on increasing numbers of practice-related tasks. Despite the differing skill and understanding levels at the different ages, play was maintained as an intact, complete activity, with players carrying out all aspects of the practice. What differed then, was not the fundamental nature of the practice nor the number of practice-related tasks that younger and older players carried out, but rather the difference was a matter of degree, whereby older and more expert players carried out the practice with a more complete understanding of it and in more deliberate ways. More specifically, these changes occurred along several dimensions.

CHANGES IN ENGAGEMENT, IMAGINATION, ALIGNMENT, AND GOALS

Engagement changed with development in several significant ways. First, engagement took on a new character in the practices with older players. This was evident in the smoother flow of play, greater attention to the task at hand and the game overall, and greater enthusiasm. Also, the nature of the relationships between players changed, with increased social ties and refined expectations for performance within practices. Players came to interact in increasingly practice-specific ways, distributing game tasks differently. This newly emerging set of social relationships also seemed to be related to an expanding set of shared historical experiences between players, resulting in better defined game roles and expectations.

Imagination also shifted in key ways. Older and more experienced players tended to have a stronger sense of the trajectory involved in becoming expert at their practice and were more committed to playing out this trajectory. This increasing awareness was linked to shifts in the practice that supported these imagined trajectories. In fact, high school players' practice supported their conceptualizations of their play.

These shifts in imagination were closely related to changes in alignment. More experienced and older players became better able and more motivated to take on the practices associated with those broader communities of practice and to conceptualize their place in this broader community in increasingly complex ways. Similarly, their practice shifted in ways that increasingly aligned their activities with players in basketball practice at the next level.

In summary, the changes in players' goals with increasing levels of practice reflected changes in engagement, alignment, and imagination. Players' goals shifted from lower level, less complex goals to higher level, more sophisticated goals. These goals reflected their understanding of and the nature of the practices in

which they took part. In this analysis, I have noted two kinds of goal changes: changes in the overarching goals of play and concurrent changes in related mathematical subgoals. Overall, shifts of both types were characterized by an increasing sophistication and differentiation. These shifts consisted of a process of refining, committing to, and becoming one of, encompassing both cognitive processes (what you need to know to become) and social processes (how becoming one of implies a set of values, norms, and practices that guide behavior).

This results of research portray a complex developmental landscape, with much intertwining, which contrasts sharply with approaches to development that tend to isolate and highlight only individual developmental changes. It is critical to note that the developmental shifts of players in basketball and dominoes were fostered by concomitant changes in the nature of the practices at the level of activity. It is also important to understand that this was not a unidirectional influence; indeed, the new ways that practices were organized afforded development at the individual level, just as players' increasing capabilities made new ways of organizing practices possible.

Intertwining of Learning, Identity, and Goals

The data presented in this article also push our understanding of the intertwining of goals, identities, and learning in practices. In the work both on basketball and on dominoes, we saw how changing identities were related to shifts in both practice-linked goals and learning. I argue that these relations can be represented by Figure 4.

Figure 4 illustrates the multifaceted, bidirectional relations between identity, goals, and learning. I discuss each of the three sets of relations in turn.

Learning creates identity, and identity creates learning. As members of communities of practice experience changing (more engaged) identities, they come to learn new skills and bodies of knowledge, facilitating new ways of participating, which in turn, helps to create new identities relative to their community. We saw this in the basketball data, where as basketball players became more engaged with the sport, they became more skilled with statistical calculations and, in turn,

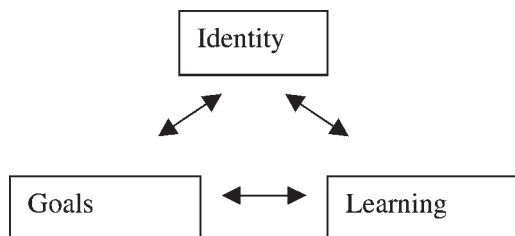


FIGURE 4 Bidirectional relations between identity, learning, and goals.

became even more engaged in the basketball community and established stronger identities as ballers.

In one part of this dynamic, new skills support the construction of more engaged identity. In the other, increasing identification with an activity or with a community of practice motivates new learning. In this sense, identities can act as a motivator for new learning, prompting practice participants to seek out and gain the new skills they need to participate in their practice more effectively. However, these shifts in learning and identities do not occur purely as an internal, intra-personal process. Rather, they occur as a part of a socially distributed, interpersonal process, whereby practices shift in ways that afford (and, indeed, require) new sets of skills, knowledge, and participation.

Learning creates goals, and goals create learning. Learning in practice also involves considering new kinds of problems and reconceptualizing old problems in new ways. As individuals learn, they come to construct new problem-solving goals: goals that are in line with an increasingly sophisticated knowledge base and shifts in broader practice-linked goals. For instance, in dominoes, increasing knowledge about the game (and an increasingly sophisticated play environment) caused players to set new and different kinds of goals in high school play.

It is also true that goals create learning. Through increasing participation in practices (and the identities associated with those practices), people come to construct (and practices come to afford) new goals in their activity. Often, to carry out these new goals requires learning: ways of interacting, bodies of knowledge, and ways of doing. This was clearly illustrated in the dominoes data when younger players began to play with the goal of scoring and then had to acquire the skills and knowledge to fulfill this new game goal.

Identity creates goals, and goals create identity. New goals are often structured in line with emerging identities in practice. As participants take on new identities vis-à-vis others in the practice and in relation to the activity at hand, they begin to construct more sophisticated practice-linked goals (increasingly aligned with those of experts). This was the case in the basketball data in that as older players identified more strongly with the sport, they began to take on (as the play context afforded) more sophisticated goals in the context of their activity, one of which was to learn to understand and calculate players' statistics.

Conversely, new goals lead to new identities. Here, participants (through the alignment of their goals with experts) begin to see themselves as more expert, hence changing their identity in relation to the practice. In the play of dominoes, the acts of constructing new game and strategy goals led players to identify more strongly with the game of dominoes.

IMAGINATION AND PROLEPSIS

In this analysis, I have pointed to the centrality of imagination in structuring learning, goals, and identity, an area that the field has only just begun to explore. This observation may be particularly important given the debate about learning in practice being an external process (of becoming) versus being an internal process (of gaining knowledge). Indeed, the importance of imagination in this process offers evidence that becoming is more than just what one does as a participant. It also include the meanings one makes of that participation. Children's ability to imagine (and the affordances for such imagination in practices) their own learning trajectories and their place in relation to others is critical to the development of new goals and access to new identities. In both dominoes and basketball, developing knowledge and ways of participating involved participants' ability to imagine themselves at the next level and to act so as to make that imagined fact a future reality.

Further, it was imagination that tied individuals to a larger, global community of practices. Players within the practice were linked to one another (and to other players) both directly and via this global community. Players' activity within their own communities of practice was structured with regard to their imagined place in the broader community, and conversely, they imagined their place in the global community in light of their relation to a local community of practice. This process, by which players' ideas about their future roles work to structure current opportunities and experiences, has been described by Stone and colleagues (Stone, 1993; Stone & Werstch, 1984) and Cole (1996). They drew on linguistics terminology to call this process *prolepsis* and argued for it as a key component of development.

In my view, the concept of prolepsis offers a way to conceptualize how ideological cultural artifacts become important factors in development, just as research has documented the critical role of physical artifacts. In the data presented in this article, imagination was crucial at many points, both in forming practice-linked identities and in taking up the goals afforded in the cultural practice. The data show how instrumental these ideological artifacts can be, both constraining and enabling the activities of practice participants.

IMPLICATIONS FOR SCHOOLING AND MATHEMATICS LEARNING

The idea that both cultural practices and the children that take part in them develop in important and complementary ways may be a valuable one for educators. School is a practice where groups of novices come together to perform academic activities, which is quite different in nature than other practices where one newcomer enters an already established group of old-timers and others in varying stages of becoming old-timers. From this perspective, we can understand learning

as novices moving through a set of increasingly complex activities within which they develop corresponding competencies. This reconceptualization may be particularly appropriate in the case of schooling, as a key question then becomes how to structure this successive set of activities in a way that maximizes learning and cognitive developmental outcomes.

In school practices, the developmental trajectory often proceeds in a piecemeal fashion, with one set of skills building on prior ones. In basketball and dominoes, the practices were not broken up into their constituent parts; for instance, domino players did not learn how to match dots and then how to add and then how to multiply successively. Nor did basketball players learn how to dribble and then how to pass and then how to interpret stats. In these practices, authentic practice was not an endpoint of the learning process; rather it was a part of the learning practice all along the way.

This raises questions about what teaching and learning practices might look like in school, and in mathematics in particular, were they to reflect this model. Children would solve authentic problems, messy ones without clear right or wrong answers, perhaps in the service of a nonmathematical goal. The sequence of topics would not be determined by an outside force (e.g., a textbook publisher) but by the teachers themselves. In many ways, these ideas map nicely onto recent reform curriculum packages and practices in mathematics.

This research also points to the importance of attending to some key meta-mathematical issues, such as how schooling environments support children's developing identities as students through the nature of their engagement. In this process, the extent to which students activities are aligned with a broader community of practice (of students or of math students) and the extent to which they imagine themselves as being committed to that community may be important factors in learning.

Implications for African American Children

In this article, I have discussed two examples of practice trajectories in which some African American students developed stronger affiliations with age and experienced concomitant shifts in their mathematical goals and associated mathematical knowledge. This trajectory of increasing participation and learning is quite different from the trajectory that many African American students exhibit in school. In fact, researchers have documented the opposite pattern in the schooling trajectories of African American and other minority children, in which students increasingly disidentify with schooling (Graham et al., 1998; Ogbu, 1992) and with mathematics classes in particular (Ginsburg & Russell, 1981; Martin, 2000).

These research studies offer important evidence for how these patterns of decreasing identity may be comprised of engagement, alignment, and imagination processes on a local level and related to the mathematical goals students do and do

not construct in the classroom: goals that are fundamentally linked to students' learning of mathematics. Hence, the model elaborated in this article offers a concrete explanatory link between identity and learning that could be used to better understand students' mathematics success and failure. It should be noted that in this model, both classroom and societal structures and children themselves are implicated in the determination of learning trajectories, thus preserving the inherent tension between the individual and the social context.

Again, there may be potential for some of the reform practices in addressing the learning and identity patterns documented in many African American and Latino youth (Carey, Fennema, Carpenter, & Franke, 1995; Fuson, Smith, & Cicero, 1997; Silver, Smith, & Nelson, 1995), although by and large, minority students attend schools where these approaches are less likely to be used or, as documented by Martin (2000), where reform practices are implemented without attention to the norms and values around math that students and parents may hold.

It may be useful for future research to explore how sequences of schooling practices for African American and other minority students form a developmental trajectory and how the practices afford new kinds of engagement, imagination, and alignment. In this process, I contend that the concept of prolepsis may be helpful, and indeed, a conversation about the concrete role of ideological artifacts and values (as socially constructed in relation to societal practices and norms) in the achievement of African American students would provide a link that has been missing thus far. Ultimately, the theoretical approach put forth in this article offers a viable alternative to deterministic environmental explanations, although still allowing for the critical role of sociohistorical factors (e.g., cultural ideas, stereotyping) in shaping African American and other minority students' mathematical achievement and learning.

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