Candy Selling and Math Learning

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An overview of accumulating research on children's out-of-school mathematics raises critical questions about how children come to form mathematical understandings in their out-of-school activities and about the interplay between informal and school mathematics learning. The author investigates these questions in an illustrative multimethod study on Brazilian child candy sellers. Findings show that sellers with little or no schooling develop in their practice a complex mathematics that contrasts sharply with school mathematics. Further, analyses reveal an interplay between what they learn in selling candy and what they learn at school: Sellers in school use their street mathematics to work school mathematics problems, and schooled sellers use some limited aspects of their school mathematics to solve problems in their practice.

It is a common belief that the principal context in which children learn mathematics is school. Clearly, this belief has merit when we consider that over the course of our social history, from pre-Babylonian times to today, civilizations have produced an immense legacy of complex mathematical systems and procedures, a legacy that children could not invent on their own. In school we attempt to teach this legacy, and children's acquisition and use of these systems have generally become identified in everyday language with *mathematics learning*.

Despite its merits, the view that children learn mathematics principally in school has been increasingly questioned. Anthropologists, psychologists, and educators have joined ranks in the study of the kinds of knowledge children acquire outside of school. They have found that children gain mathematical understandings in out-of-school contexts, but the mathematics may only on occasion resemble that of the classroom. This recent work has expanded our conceptions of what counts as mathematics as well as opened up important new questions about how children acquire basic mathematical concepts.

One context in which researchers have documented out-of-school mathematics learning is in the everyday activities of the preschooler. In a recent investigation, colleagues and I found that young children from both middle and working class homes are typically engaged with a remarkable array of activities involving number, including games of mothers' and childrens' own invention, like counting stairs; store-bought games involving number; and educational television shows, like Sesame Street (Saxe, Guberman, & Gearhart, 1987). The numerical understandings that children generate in these activities are remarkable, and, in some respects, they are different from those they later acquire in school. In our own research and in the work of other investigators, we find that even 2- and 3-year-olds have considerable competence in counting objects (Fuson, 1988; Gelman & Gallistel, 1978; Gelman & Meck, 1983; Greeno, Riley, & Gelman, 1984; Schaeffer, Eggleston, & Scott, 1974). Further, by 4 years of age, most children extend their early counting knowledge to comparing and reproducing sets (Ginsburg & Russell, 1981; Saxe, 1977; Saxe, 1979) as well as to addressing simple arithmetical problems with small sets (Groen & Resnick, 1977; Klein & Starkey, in press). Unlike school math, the preschooler's mathematics is not linked to an orthography for number; the very young child's mathematics may even be based on an idiosyncratic list of number words rather than our standard one (Fuson, Richards, & Briars, 1982; Gelman & Gallistel, 1978).

Other contexts in which out-of-school mathematics has been investigated are the activities of children and adults who have limited formal schooling. Children and adults construct complex strategies to address arithmetical problems that emerge in everyday commercial transactions (Carraher, Carraher, & Schliemann, 1985; Carraher, Schliemann, & Carraher, in press; Guberman, 1987; Pettito, 1982; Posner, 1982; Saxe, 1982) and in work activities such as tailoring (Lave, 1977) or loading cartons (Scribner, 1984). Individuals also develop concepts of measurement and of mathematical progression in doing tasks like weaving (Greenfield & Childs, 1977; Saxe & Gearhart, in preparation; Saxe & Moylan, 1982), pottery making (Price-Williams, Gordon, & Ramirez, 1969), grocery shopping (Lave, Murtaugh, & De la Rocha, 1984) and even weight watching (de la Rocha, 1983). Like the preschoolers' math, this mathematics often has only a distant resemblance to classroom mathematics; individuals usually do not use a written symbol system to produce mathematical computations but rely, instead, on invented procedures that may include mentally regrouping terms to arrive at sums or manipulating objects in computations. Perhaps an extreme instance of the invention of a system of mathematics has been documented among unschooled Oksapmin adults from a remote and recently contacted group in Papua New Guinea. The Oksapmin are adapting their traditional 27 body-part counting system to solve new problems that arise in the commercial transactions introduced by a money economy (Saxe, 1982).

What comes out of the accumulating research on out-of-school practices is the view that mathematics learning is not limited to acquisition of the formal algorithmic procedures passed down by mathematicians to individuals via school. Mathematics learning occurs as well during participation in

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cultural practices as children and adults attempt to accomplish pragmatic goals. The contrast between a school mathematics linked to Western cultural history and a mathematics linked to out-of-school activities is remarkable. It prompts fundamental questions about how children come to develop mathematical forms so pervasive in everyday life and whether there is an interplay between children's constructions of these forms and their developing understandings of school mathematics.

This paper presents a research approach to these issues through a summary of some of my recent work with child candy sellers who live in an urban center in northeastern Brazil (Saxe, in preparation). These candy sellers are a population in which the questions raised by the accumulating research are extraordinarily amenable to study.

As an inherent part of candy selling, children must construct fairly complex mathematical goals, goals that take form in a web of such socio-cultural processes as an inflating monetary system, practice-linked conventions, and patterns of social interaction. Observing sellers, who range in age from 5 to 15, enabled me to document how children's mathematical goals emerge in the practice and to gain some appreciation of the interplay between social and developmental processes in the emergence of these goals. Additionally, interviewing experienced sellers about their mathematical understandings provided a basis for addressing a number of central issues.[1] Contrasting the mathematical understandings of unschooled sellers and nonsellers revealed the nature of sellers' understandings and indicated whether plying their trade led children to form particular kinds of mathematical concepts. Further, contrasting the mathematics of unschooled sellers at different age levels produced insight into how sellers' mathematics came to take the form it did. Finally, the interviews allowed understanding the interplay of schooling and selling experience. Some candy sellers did attend school; contrasting the way same-aged sellers with different amounts of schooling addressed practice-linked problems revealed whether the children had incorporated school-linked math forms into the math for selling candy. Conversely, contrasting the way both nonsellers and sellers who attended school addressed school-linked mathematics problems showed whether sellers had incorporated understandings constructed in candy selling into school mathematics.

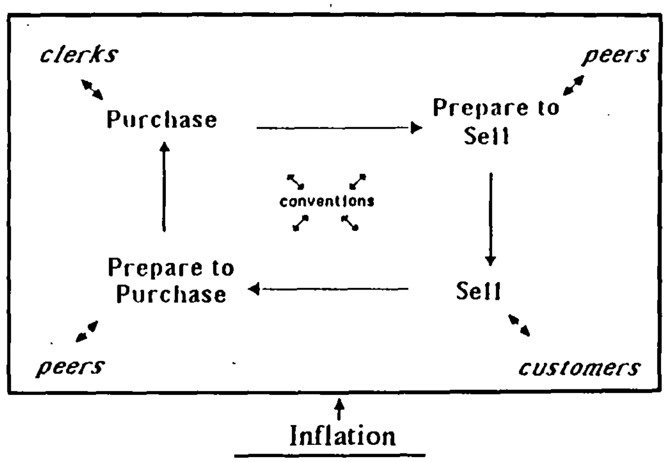
The Candy Sellers' Practice

To learn about the mathematical goals that sellers form in the practice required an analysis of the social processes of the practice and how sellers goals are interwoven with them. To accomplish this, I conducted a series of observational studies of sellers as they conducted their trade (Saxe, in preparation).

Figure 1 contains a schematic of the candy selling practice. The practice has a cyclical structure, depicted by the inner rectangle in the figure. To sell candy, one must accomplish four basic tasks. During a *purchase phase* (left upper corner of inner rectangle), sellers must buy one or more boxes of candy from one of about 30 wholesale stores, boxes that may contain any one of a wide variety of candy types. In a *prepare-to-sell phase*, sellers must price their candy for sale in the streets, a task in which they must mark-up the wholesale price for a multi-unit box to a retail price for units. In a *sell phase*, children must exchange their goods for currency with customers. In a *prepare-to-purchase phase*, sellers must prepare for the purchase of a new box of candy, a task that may involve estimating what candy types are most in demand and coordinating those considerations with possible comparative pricing at different wholesale stores.

Three social processes depicted in Figure 1 influence the form sellers' mathematical goals take in each phase of the practice. Brazil's *inflation* rate, which was 250% at the time of the study, is a socioeconomic process that not only affects the magnitude of the values that sellers address in their everyday calculations (a box of candy ranged between Cr$ 3600 [3600 cruzieros] and Cr$20,000 over the course of the study), but also produces a need for children to adjust for inflation in retail pricing. Social *conventions* that have emerged over the history of the practice may simplify some types of mathematical problems but complicate others. For instance, the price ratio convention of selling a fixed number of candy units for a specific bill denomination (e.g., 3 bars for Cr$1000) simplifies on-the-spot computations because

FIGURE 1.
The Candy Selling Practice and Related Social Processes



it reduces the likelihood of computations involving change (and odd values in computation); however, the convention also leads to ratio comparison problems that arise when a seller contrasts his own price ratio with another seller's or when he chooses to sell for more than one price ratio (e.g., 3 lifesavers for Cr$500 and 7 for Cr$1000). Finally, *social interactions* further modify the nature of the mathematical problems of the practice. For instance, some wholesale store clerks occasionally help sellers with the math in their purchase by reading the prices of candy boxes or aiding sellers' with their mark-up computations. Other pertinent interactions include the sellers' collaborations on price setting and their bargaining transactions with customers.

Methods for Studying Sellers' Mathematics

To understand sellers' mathematics, tasks and interview procedures were designed to document four general areas of sellers' practice-linked understandings: (a) representation of large numerical values, (b) arithmetical manipulation of large values, (c) comparison of ratios, and (d) adjustment for inflation in wholesale to retail markups. In this summary, I sketch some of the methods and the results for the first three of these four mathematical domains.

Representation of large numerical values. There are two ways that sellers could represent large numerical values in the practice. One is through our *standard orthography*. The prices of candy are often posted in the wholesale stores, and the ability to read these values would be useful to sellers. Further, in various phases of the practice, sellers must solve arithmetical problems containing large values, and the standard number orthography would be useful in solving such problems. An *alternative system* to represent large numbers in problem solving would be to use currency units as tokens for number by identifying the numerical values of currency units on the basis of their different figurative characteristics (e.g., colors, pictures) and manipulating these units in problem solving. Such an alternative system coupled with the assistance of store clerks and peers to help read prices could also serve as a representational vehicle in solving practice-linked problems.

To determine the sellers' competence with both representational systems, I developed assessment tasks. For the *standard orthography task*, they were asked to read and compare 20 multidigit numerical values, values that were within the range that they addressed in their practice. To determine their ability to use currency as an alternative system for large number representation, I constructed two types of additional tasks. In *bill identification tasks*, the sellers were presented with 12 bills (or printed bill values) in each of three conditions (see Figure 2a): i. standard bills, ii. bills with their numbers occluded by tape, iii. photocopies of cutouts of the numbers. They were required to identify the values of the bills or numbers in each condition. In the *currency comparison tasks*, they were presented with 14 pairs of currency units and asked to tell which was the larger of the two (e.g., bills of Cr$200 and Cr$1000) as well as the multiplicative relations between units, that is, how many of the smaller units were equivalent to the larger unit (see Figure 2b). If sellers can identify currency units and compare them numerically, they have the basis for a representational system to manipulate large numerical values, a system that would serve them well in their everyday computations.

FIGURE 2a.
Bill Identification Conditions

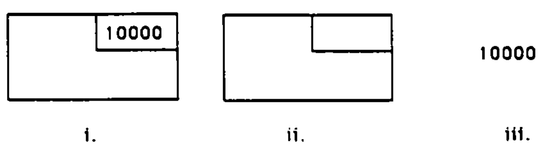
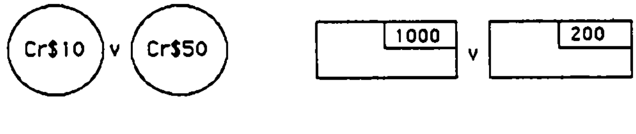


FIGURE 2b.
Currency Comparison Conditions



Arithmetic with large currency units. The ability to produce arithmetical computations with large sums of currency is an achievement of central importance to the selling practice. To assess this ability, I created tasks that required sellers to add and subtract large sums. In one addition problem, for example, sellers were handed a stack of 17 bills (in a standard but haphazard order) totalling Cr$17,300 and told "Suppose you started the day with this amount. Would you add the money for me?" In another, they were asked to produce change for a purchase of Cr$7600 for a bill of Cr$10,000.

Comparison of ratios. In presenting their merchandise to potential customers, sellers often use more than one pricing ratio. For instance, a seller may offer 5 bars for Cr$1000 and 2 bars for Cr$500. Although the use of multiple ratios should increase sales by providing customers with lower prices for larger quantities, it also increases the complexity of the mathematics of selling. Clearly, the ability to produce ratio comparisons would be important for sellers who are considering using multiple prices for their candy.

To assess their understanding of ratio comparisons, sellers were presented with problems in which they had to determine which of two pricing ratios would yield a larger profit. For instance, a seller was told, "Suppose that you bought this bag of *Pirulitos*, and you must decide the price you will sell the units for in the street. Let's say that you have to choose between two ways of selling: selling 1 Pirulito for Cr$200 or selling 3 for Cr$500 (1 Pirulito was placed next to a Cr$200 bill and 3 were placed next to a Cr$500 bill). Which way do you think that you would make the most profit?" Children were also asked, if they did not do so spontaneously, to justify their choice.

Studies of Sellers' Mathematics

The battery of assessment tasks provided tools to address questions reviewed earlier about properties of sellers' mathematics, the way this mathematics develops, and the way children may use understandings developed in one context (school or the practice) to address problems that emerge in the other.

Influence of selling on children's mathematics. My first question was whether sellers were constructing mathematical understandings linked to their practice. To this end, I interviewed 23 10- to 12-year-old candy sellers who had minimal schooling[2] and I contrasted their performances with two groups of nonsellers who were matched with the sellers for age and schooling level, a group of 20 urban children from the same commercial environment as the sellers and a group of 17 rural children who use the same currency system but whose level of exposure to commercial transactions was more limited. I reasoned that if engagement with the practice-linked mathematical goals was leading sellers to construct specific forms of mathematical understandings, then we should observe a particular pattern of findings in children's performances. Because children had limited, if any, schooling, I suspected that all would perform poorly on the standard orthography tasks. For those problems that were common to all groups, like using currency to represent large values, group performance should not appreciably differ. For problems more specific to frequent commercial transactions, however, problems like bill arithmetic and ratio comparisons, performances should show differences as a function of level of involvements with these problem types.

The results of children's performances for each general type of problem, as a function of population group, are summarized in Figure 3a. Clearly, performance varied across groups for some problem types but not others, and these variations largely corresponded to expectation.[3]

Children's performances on the two number representation task types, the standard orthography tasks and the alternative representation tasks (bill identification and currency comparison), differed markedly. On the standard number orthography tasks, few performed well; the highest performing group, the urban nonsellers, read only one-half of the values correctly. In contrast, on the alternative representation tasks, virtually all performed at or near ceiling. The lack of group differences on these tasks indicates that children growing up in Brazil, with minimal education, regardless of selling experience, develop an understanding of the organization of the currency system to a sufficient extent to use it to represent and compare large numerical values.

Children's performances on the problems more closely linked to the selling practice, the bill arithmetic tasks and the ratio comparison tasks, show that sellers more frequently demonstrated adequate solutions than urban or rural nonsellers, and that the urban nonsellers, in turn, demonstrated more adequate solutions than the rural nonsellers. For the arithmetical problems, differences were moderate, whereas, for the ratio tasks, differences were more extreme.

Children's solution strategies on these more complex tasks reveal the character of sellers' mathematics. Typical solution strategies on addition problems were to manipulate bill values into convenient groups. In such manipulations, a child might shift an order of bills from Cr$500, 200, 500, 200, 100 into [500+500] [200+200+100]. Though this was a common strategy, many of the sellers were capable of producing accurate summations without such manipulations. Virtually none used paper and pencil solution strategies to solve any of the addition or subtraction problems. For the ratio problems, children's adequate solutions were accompanied by an explanation in which they equated ratios by reference to a common term. For instance, in determining the ratio that would yield a larger profit, 3 for Cr$500 or 1 for Cr$200, they might argue that 1 for Cr$200 was the more profitable ratio, because 1 for Cr$200 would yield Cr$600 for the equivalent number of candies.

Sellers' mathematics as a function of age. Having established that children develop specific forms of mathematical understandings as a function of their engagement in the candy selling practice, my next concern was to understand the changing character of sellers' mathematics as a function of their age. On the basis of the observational studies, it was clear that the practice itself has considerable tolerance for sellers of varying levels of mathematical competence. For instance, upon questioning about how they priced their boxes for retail sale, the younger (6- to 7-year-old) sellers said that an older person (e.g., mother, older sibling, older peer) told them what retail price to use, whereas older sellers typically performed the calculation themselves (or received some assistance in their calculations from others). Further, the young children typically sold their candy for only one ratio and thus did not confront problems of ratio comparison, whereas older children sold their candy for more than one pricing ratio and did address ratio comparison problems in their practice. Finally, wholesale store clerks sometimes aided sellers with their calculations, aid that was typically prompted by sellers' requests for help.

Courtesy of Geoffrey B. Saxe

Child performs arithmetical computation with currency.

Such forms of social supports mean that the central mathematical goal of the practice for the young seller may be merely that of appropriately identifying a many-to-one ratio between candy units and bill denominations in retail sales transactions with customers (for example, making an exchange of three candy bars for a Cr$1000 bill). Although using only one price ratio may have handicapped some younger sellers in accomplishing sales, it was compensated by customers' tendency to extend more sympathy to younger sellers; indeed, 6- to 7-year-old sellers accomplished about twice as many sales transactions per time interval than did the 12- to 15-year-old sellers.

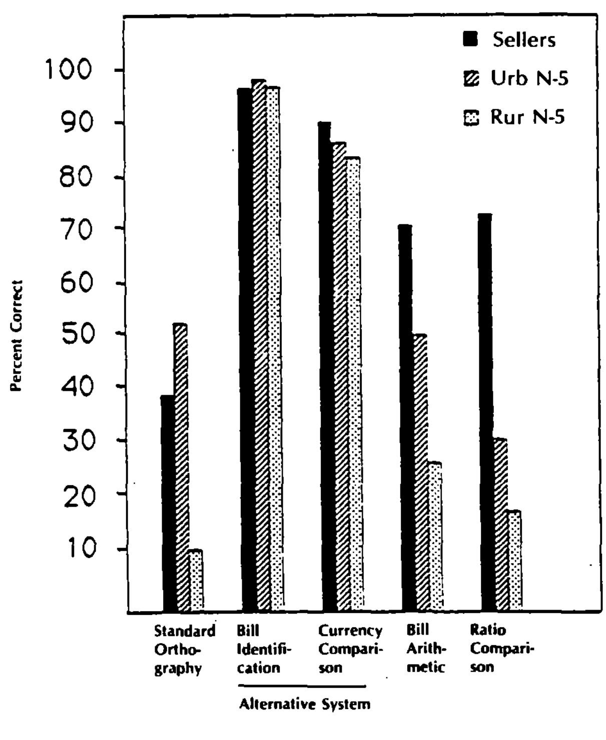
To determine the character of sellers' developing mathematical knowledge as a function of age, sellers from three age groups, none of whom had progressed beyond the 2nd grade, were interviewed individually using the tasks outlined. The groups consisted of 5- to 7-year-olds,[4] 8- to 11-year-olds, and 12- to 15-year-olds. The observations noted suggested that young sellers may perform well on the alternative representational system tasks, but performances on the other tasks may be quite limited. With age, sellers' participation with the more complex problems of the practice increases, and we should observe corresponding developments in their solutions to these problems. Figure 3b contains a summary description of the three groups' performances, which bore out these expectations.

For the standard orthography tasks, the young children identified virtually no values correctly. Although their knowledge of the standard orthography improved with age, sellers' performances remained at relatively low levels, even in the oldest age group. In contrast, for the alternative representation system tasks, they performed at or near ceiling, an ability that would serve them well in exchanges with customers.

Age differences on the mathematically more complex problems of the practice, currency arithmetic and ratio comparison, also show the anticipated trends. In the currency arithmetic problems, some of the young children appeared not to identify the goal of the task as defined by the interviewer. For instance, on the bill addition task, several interpreted the problem as involving merely an enumeration of bills and counted them, whereas others treated the task as involving recognition of currency denominations and identified the values of the bills sequentially. For the ratio comparison tasks, younger sellers typically understood the problem as merely one of identifying the larger currency unit. With age, sellers showed increasingly sophisticated means of both producing arithmetical computations with bills and comparing ratios.

FIGURE 3a.

Percent of Items Correct as a Function of Problem Type and Population Group

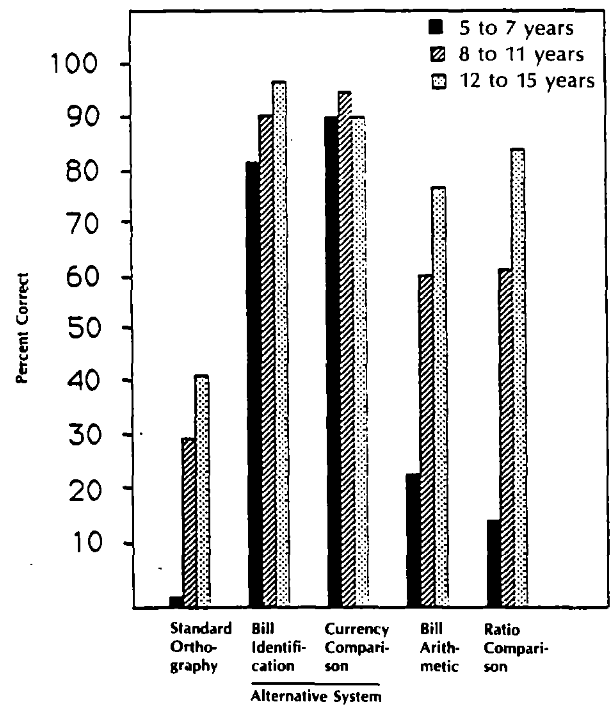


The Interplay Between Math Learning in School and Math Learning in Selling Candy

The mathematics of the selling practice clearly differs in form from the orthography-based mathematics of school, a mathematics that is linked to the place-value structure of our notational system for number and to associated procedures for computation (e.g., carrying and borrowing algorithms). In the following two sets of analyses, my concern was to understand whether children were using mathematical knowledge constructed in one context to address problems in the other.

FIGURE 3b.

Percent of Items Correct as a Function of Problem Type and Age Group

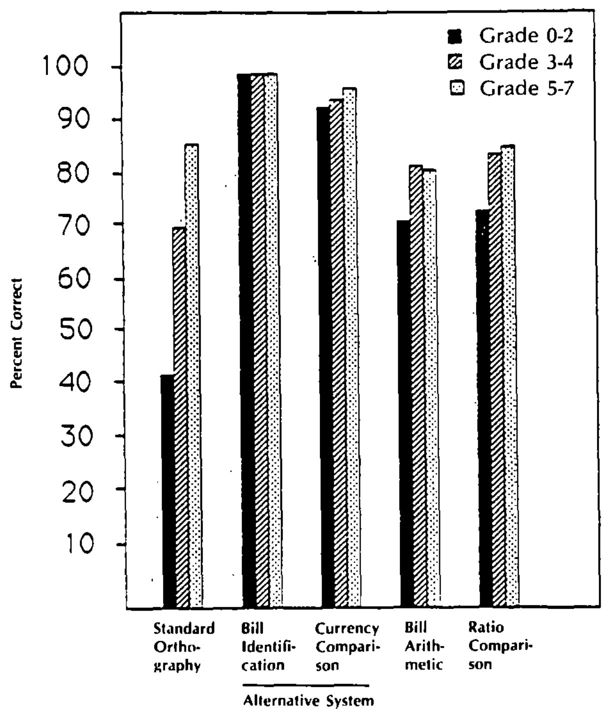


Schooling and sellers' practice-linked mathematics. To study the influence of schooling on the mathematics children develop in the candy selling practice, I contrasted the performances of three groups of sellers approximately matched for selling experience and age (ranging from 12- to 15-years old) who differed in the extent of their school experience (never attended, to attended through 2nd grade; attended up to 3rd or 4th grade; and attended up to 5th through 7th grade).

The contrasts between performances of sellers with different extents of school experience on the practice-linked tasks are illustrated in Figure 3c. Clearly, sellers with greater levels of schooling achieved higher levels of performance on the number orthography tasks. A related difference in performance, not represented in the figure, was in schooled sellers' use of the standard orthography in solving the practice-linked problems. For instance, for the subtraction problems of the bill arithmetic tasks, schooled sellers more frequently made use of the standard orthography than those with less schooling; they used standard notation to represent and sometimes to solve the problems. There was, however, no statistically significant difference in sellers' accurate solutions of currency arithmetic and ratio comparison tasks as a function of schooling experience. Thus, although schooling may have influenced the way some sellers addressed and solved mathematical problems emerging in the practice, there was no evidence in this study that schooling led sellers to achieve more correct solutions of practice-linked problems.

FIGURE 3c.

Percent of Items Correct as a Function of Problem Type and Level of Schooling (Sellers Only)



Practice participation and sellers' school-linked mathematics. To study the influence of the children's participation in the selling practice on their performance with problems typical of school, the performances of sellers who attended school were contrasted with those of nonsellers who attended school. In this study, rather than administering practice-linked problems, a new set of assessment procedures was devised to study properties of the mathematics children use in school contexts. These assessment procedures consisted of twelve arithmetical problems, some presented in computational (column) format and others in word problem format.

To determine whether participation in the selling practice influenced children's solution of school-linked mathematics tasks, the school problems were administered to 2nd and 3rd grade sellers and nonsellers who were about the same age. I reasoned that if participation in the selling practice influenced the way children solved school mathematics tasks, we should observe that children with selling experience would use different strategies to solve the school problems and achieve higher levels of accuracy.

Children's solutions were coded both for correctness and strategy. Strategies were coded as one of two basic types: *algorithmic strategies,* in which children used school-linked algorithms to solve the problems (e.g., proceeding by column right to left); and *regrouping strategies,* in which they formed convenient values by regrouping the terms of a problem (e.g., $28+26=?$ became $(20+20)+(8+6)=?$), a strategy analogous to that used in currency arithmetic to solve practice-linked addition problems.

The tabulation of the strategies used to achieve accurate solutions is presented in Figure 4. Clearly, at 2nd grade, sellers more frequently achieved accurate solutions. Further, the strategies that sellers used to achieve these solutions were almost exclusively regrouping ones and likely reflected ways of doing bill arithmetic in their practice. By 3rd grade, these differences in accuracy and strategy type were attenuated, an attenuation that suggests that school had begun to have an equalizing effect on children's mathematical competence.

Cognition in Context

These studies highlight an interplay between social and developmental processes in candy sellers' mathematics learning. Through practice participation, these children construct and operate on mathematical problems that are influenced by social conventions (like pricing ratios), artifacts of culture (like the inflated currency), and social interactions (like assistance with computations provided by clerks). Moreover, the way these social processes influence sellers' construction of mathematical problems shifts with their ages: Young sellers typically use only a single pricing ratio and thus avoid problems of ratio comparison, whereas their older peers use multiple pricing ratios and are engaged with ratio comparison problems. Young sellers typically identify bill denominations in transactions with customers but are not involved with complex arithmetical problems with large values, whereas older sellers are involved with such computations in their transactions. Finally, younger sellers receive considerable assistance in pricing their goods for retail sale, whereas older sellers more frequently attempt these calculations on their own.

In dealing with practice-linked problems, unschooled candy sellers develop a mathematical system, one that their nonselling peers do not achieve at the same age, if at all. For the young sellers as well as the nonsellers, the early manifestation of the system is their use of the medium of exchange, Brazilian currency, as a representational system for number. Both the ability to identify currency values and knowledge of the numerical relations between values provide an alternate to our standard orthography that is effective in retail exchanges with customers. As sellers become involved in the more complex problems of the practice, their

Courtesy of Geoffrey B. Saxe

Children collaborating in price setting transactions.

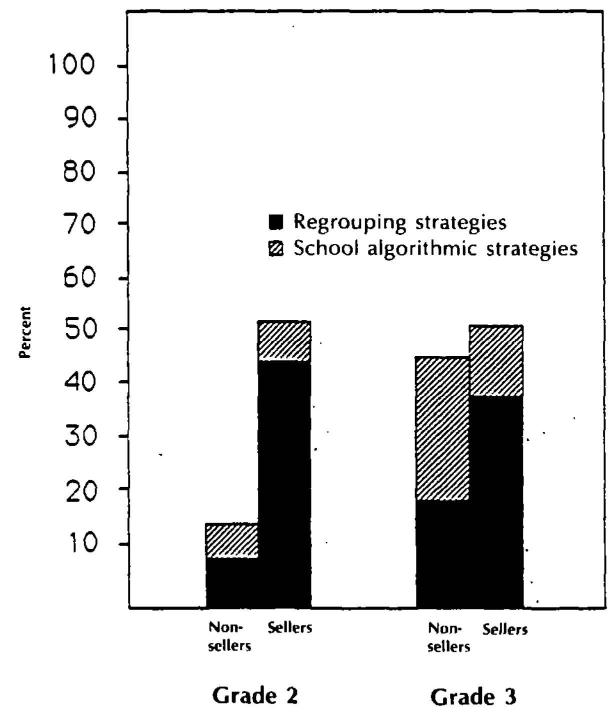
mathematical system becomes increasingly distinct from that of their nonselling peers. Sellers use their knowledge of bill values and relations between them to develop arithmetical problem solving strategies that draw on the structure of the currency system. More and more, they construct concepts of ratio, knowledge forms linked to pricing conventions that have emerged over the history of the practice. Thus, sellers develop a mathematics that is adapted to the practice and, over time, manifests mathematical operations of increasing complexity and power.

The sellers' practice-linked mathematics thus appears to be tightly interwoven with socio-cultural artifacts and supports. This apparent interdependence between cognition and context could indicate that sellers' understandings have limited generality. However, the findings on the interplay between sellers' knowledge constructed in the practice and in school show that individuals can make use of knowledge formed in one context to address problems in the other. We saw that sellers who attended school worked towards adjusting practice-linked regrouping strategies to solve school-linked mathematical problems. We also saw some evidence that the process works in the opposite direction; sellers who had more school experience had greater knowledge of the standard orthography for number and on occasion adjusted the orthography-based column arithmetic that they had acquired in school to practice-linked problems, though these efforts at transfer from school to practice did not influence the accurateness of sellers' solutions. In both cases, the character of children's solution strategies on the mathematics tasks is evidence that such processes of transfer are often protracted ones, ones in which sellers increasingly specialize and adjust strategies formed in one context to deal adequately with problems that emerge in another (see Saxe, in press-b).

Sellers clearly draw on what they have constructed through plying their trade to address the mathematical problems of the classroom. Research in other cultural settings shows that such adaptations are not limited to candy sellers but may be a very common phenomenon (Baroody, 1987; Saxe, 1985). These uses of out-of-school mathematics in school, whether finger counting strategies to solve an arithmetic problem presented in a 1st grade classroom or sophisticated regrouping strategies to solve multidigit multiplication problems later, could be viewed as the intrusion of inappropriate and primitive strategies that should be adaptively replaced by the formal mathematics of the classroom. However, many researchers now recognize the pedagogical importance of using linkages as means of strengthening children's mathematical intuitions (Ginsburg & Asmussen, in press; Carraher, Schliemann, & Carraher, in

FIGURE 4.

Percent Correct Solutions as a Function of Grade Level and Selling Experience



press; Hiebert, 1984; Hatano, in press; Hughes, 1986) and recommend appropriate classroom techniques to facilitate and build on these linkages (Baroody, 1987). Clearly, we would profit from systematic empirical work exploring ways we may help children to use what they know to decipher the mathematics of school instruction.

The bridges that children build from the mathematics of the classroom to the problems that emerge in out-of-school activities are no less important concerns for educational practice. Indeed, a worthy instructional objective is for children to feel some ownership of classroom mathematics, a possibility only if classroom mathematics becomes transparent and functional to them. While they were subjects in the interview study, some sellers did use math linked to school to address out-of-school problems, however, the influence of schooling on sellers' out-of-school mathematics was not major. Indeed, the greatest effect of instruction found in this study was to improve children's ability to decode the standard number orthography. The breach between school mathematics and the mathematics used in everyday tasks is probably not unique to candy sellers. These results, like the accumulating research on children's and adults' out-of-school mathematics, point to the need to examine how we can better make classroom mathematics more readily accessible and transparent to children as they approach and pursue problems in the course of their everyday out-of-school activities.

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[1]Sellers interviewed all had worked at their practice for a minimum of 3 months (often 7 days-a-week), but most sellers who participated in this study had considerably more experience.

[2]Minimal schooling was defined as never having attended school beyond 2nd grade (public school).

[3]A more detailed analysis of these data is presented in Saxe (in press-a).

[4]The 5- to 7-year-olds were a heterogeneous group because only a small number of candy sellers in this age range could be found. Although all children in this group were involved in commercial activities, only 6 were actually candy sellers. The remaining children helped their parent(s) in selling such commodities as vegetables and may be better defined as "seller-initiates."

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