The 100s Chart: A Stepping Stone to Mental Mathematics

Carol A. Thornton, Graham A. Jones and Judy L. Neal

"I want a hamburger, cider and apple pie," said Katie. Kirk thought, "That's 25 and 11, that's 35, 36, and 20 for the apple pie makes 46, 56¢." Katie replied, "That's right. I got out a quarter for the hamburger, a dime and a penny for the cider, and two more dimes for the apple pie and counted 25, 35, 36, 46, 56¢" (see Figure 1).

FIGURE 1

Menu used to place orders and calculate cost

MENU

Main dishes		Drinks	
Slice of pizza	35c	Milk	9c
Hot dog	25c	Cider	11c
Spaghetti	30c	Soft drink	11c
Hamburger	25c	Milk shake	19c
Vegetables		**Desserts**	
Ear of corn	10c	Chocolate-chip cookies	20c
Baked potato	10c	Apple pie	20c
French fries	20c	Ice cream	20c
Baked beans	10c	Caramel apples	20c

Moving on, Mrs. Neal heard another group of her second graders placing their orders. "I want pizza, corn on the cob, a chocolate chip cookie and a milkshake," said Brandon. Brandon used a 100s chart like that shown in Figure 2 to help find his total. Starting on 35 for the pizza, he moved down the columns and counted on by tens for the corn and cookie: "35, 45, 55, 65"; then, for the 19¢ milkshake, he moved down two more rows and went back one space. "That's 84¢ for me." Naoko said, "I worked it out in my head, and I got 84¢ too."

The children were practising for the annual festival time, when almost everyone age seven and up in the small town took turns working in booths. As it would be her students' first time to participate, Mrs. Neal prepared her own menu to let them practise taking orders and calculating costs. On festival day, each child would work with a family helper, but to practise, the children worked in pairs and checked each other's calculations.

Different Solution Strategies

The children performed the calculations in different ways. Kirk and Naoko calculated the cost mentally, Katie used coins and Brandon turned to the 100s chart for help. Except for several students who needed to work with cubes, these solution strategies were typical for these second graders.

Mrs. Neal thought this group was also typical of her former classes, in that children worked at different levels. Over time, she recognized the value of taking a more flexible approach to problem situations, believing children needed to work through learning stages before they spontaneously moved on to mental calculation. She was glad that the school's parent group had sewn "chair packs" to hold each child's mathematics materials (see Figure 3). This arrangement gave children ready access to various manipulatives whenever needed.

Looking Back: Good Beginnings

Why could Kirk and Naoko, as second graders, do mental calculations, whereas some older students could not? People differ, of course, but Mrs. Neal decided that much could also be attributed to a good foundation in mathematics. She recalled an

FIGURE 2

The 100s chart

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

FIGURE 3

Mathematics chair pack

observation that another local teacher had made after being moved from first to fourth grade:

> I'm convinced that you have to start early to nurture number sense and create a mind-set for working mentally with numbers. My first graders last year were more flexible and creative in their thinking for the 'Number of the Day' (Slovin 1992) than my fourth-grade group is now, even after working with them for nearly seven months.

Looking back, Mrs. Neal believed that her second-grade group had had a good foundation in mathematics. She remembered how the first-grade teacher, Mrs. Haas, had also focused on a "Number of the Day" in the spirit of the Slovin (1992) article and had often challenged the children to tell her as much as they could about such problems as 34 + 9 or 125 + 125, but to give no answers.

Mrs. Neal also knew that Mrs. Haas had laid a foundation by incorporating *counting* and *counting on by 10s and 1s* as a regular part of her daily opening. She smiled as she recalled the counting problems Mrs. Haas had created on the *Cloudy with a Chance of Meatballs* theme (Barrett 1978). The children loved this story, in which all kinds of food rained down on the town of Chewandswallow! She remembered stopping by the first-grade class one day when the children were using cubes to solve "meatball" problems:

> After a big meatball storm, Henry's family packed meatballs in bags of 10. There were 7 bags and 3 extras. Then Henry packed another 2 bags from meatballs he had found out back. How many did they find?

In retrospect, Mrs. Neal believed that these experiences had helped Kirk and Naoko to develop successfully the mental skills they had used in calculating festival orders.

At first, Kirk and Naoko had used cube trains to solve such problems. When they learned how quickly they could solve them using a 100s chart, they turned to the chart instead and soon were solving even harder problems. For example:

> On Monday, it rained 33 meatballs in Henry's yard. On Tuesday, it rained 29 more. How many then?

They would start with 33, move down 30, or three rows, to 63, then move back one space to 62.

Developmentally, Kirk and Naoko were ready to capitalize on the power of the 100s chart before many of Mrs. Neal's other students. The strength of the visual imagery furnished by the chart enabled these students to move quickly to carry out most calculations mentally. Kirk said he didn't need the chart because he could " 'see' the moves in my head." Quite naturally, both children sometimes reverted to using the chart, especially when solving problems with larger numbers.

Recognizing that many second graders might be ready to progress as Kirk and Naoko had, Mrs. Neal revisited the 100s chart. She challenged her students to describe and justify the patterns they discovered. Brandon observed, "When you move right, you add 1; when you move left, you subtract 1. When you move down, you add 10, and when you move up, you subtract 10. See [pointing], the numbers in this row are all 10 more than the numbers in the row above it."

To encourage children to apply these patterns, Mrs. Neal used literature-based problems involving addends of 10, 9 and 11:

> On Wednesday morning, Mom found 14 waffles on the porch. She needed 10 more. (How many would that be?) She only found 9 more. (How many did she have for Wednesday's breakfast?)

At first, Mrs. Neal tried to pose pairs of related problems like this one on purpose, so that students could make the connection between 14 + 10 and 14 + 9, or even 14 + 11. In a similar way, she later introduced addends like 40, 39 and 41. Brandon, like Kirk and Naoko at an earlier stage, was beginning to value the power of the 100s chart.

Other children preferred to use cubes grouped in trains of 10 for solving the problems or sometimes checked their 100s chartwork on a calculator. Marita said: "I put out a train of 10 cubes and 4 ones to show how many waffles Mom found on the porch. Then I

added an extra 10-train to find how many were needed altogether. I just took one away to see how many Mom actually had for Wednesday's breakfast."

At one time, it would have concerned Mrs. Neal that these children were not progressing more quickly to the 100s chart or mental mathematics. However, she was becoming sensitive to children's thinking and individual learning levels and more reflective in accommodating these differences in her teaching.

Mrs. Neal was delighted that the festival was imminent. It presented a timely context for a learning activity that allowed her to observe and assess children's progress on the concrete-to-mental mathematics continuum.

Reflecting on the Reflection

In this series of reflections, Mrs. Neal recognizes the value of encouraging children to develop various computational processes as well as a range of solution approaches. She believes that such encouragement leads children to be more flexible, confident and independent problem solvers. Note how Mrs. Neal was willing to accept and encourage a range of solution approaches to the waffle problem, including Marita's use of cubes, Brandon's reliance on the 100s chart and other more mature mental approaches.

In addition, she recognizes the significance of posing problems and assessing understanding in a context familiar to the children. In the first example, she relates mathematical tasks to experiences that children were likely to have in the upcoming festival. Later, she uses problems developed from familiar stories from literature.

Consistent with the *Curriculum and Evaluation Standards for School Mathematics* (NCTM 1989, 46), Mrs. Neal believes in delaying written computation to furnish a maximum opportunity for other computational processes to grow and mature. In essence, this approach gives children time to gain competence and confidence in using a variety of nonwritten computational strategies. Her previous experiences in delaying written computation have shown her that children are more inclined to adopt flexible strategies for computing and to make better use of their repertoire of manipulative, mental and written approaches.

Mrs. Neal's thoughts model those advocated in "Standard 6: Analysis of Teaching and Learning" of the *Professional Standards for Teaching Mathematics* (NCTM 1991) and, accordingly, can potentially influence learning in a significant way. In this instructional episode, observing and analyzing the progress her students made toward mental mathematics helped Mrs. Neal recognize the power of the 100s chart as a bridge that enables children to move from solving problems with concrete materials to solving them mentally.

Bibliography

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