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Calendar Math in Preschool and Primary Classrooms: Questioning the Curriculum

Elizabeth Ann Ethridge[1,2] and James R. King[1]

The Early Childhood profession would benefit from a systematic inquiry into "calendar math". The authors offer an organized framework for this work. After a description of calendar math practices, the authors examine problematic aspects of its implementation, based on developmental theory. The essay concludes with a call for more reflective teaching practice about the match between teacher intentions and student outcomes.

KEY WORDS: calendar math; teacher reflection; preoperational stage; early childhood curriculum inquiry.

INTRODUCTION

I was exposed to calendar math during my second year of teaching. At the time, I was teaching Transitional First Grade in an elementary school that was divided between early childhood practices and traditional teaching practices. The teachers from first grade and up were very critical of the early childhood program and often dismissed us with the comment, "All they do is play". We had faculty meetings in which the early childhood teachers defended their teaching practices. In addition, early childhood faculty had been ridiculed and undermined to the parents of students and to the School Board of Education. Paradoxically, at this same time, teachers from across the state were coming to observe our Early Childhood program and we were often asked to present our model of teaching at local and state conferences.

I learned about calendar math from a workshop on "Math Their Way" and I immediately implemented it in my classroom. I felt relieved that I finally had a way to demonstrate to others the skills I was teaching and the concepts my students were learning. When teachers from the upper grades came to my classroom, I proudly explained the calendar math activities displayed on the wall. The principal had previously stated that he had stopped by my classroom to observe me but never found me engaged in direct instruction. Now, with calendar math, I could let him know when I would be "teaching". I also felt relieved and validated that there was evidence of my students' "learning". With the other activities that I facilitated for the students, I seldom received immediate feedback that my students had "learned". With calendar math, the students soon learned to give the desired response for each question I asked.

Calendar math was a source of relief and pride for me as a teacher in a school environment that I perceived to be hostile. No longer could my critics say that all we did was play in my class. This sense of validation lasted for almost 6 months. At that time, I was engaged in a small group activity with students and through our discussion I realized that they did not understand some of the concepts we addressed through calendar on a daily basis. As a result, I started checking on the understanding of the concepts covered through calendar math for the entire class. I found that most of the children grasped number recognition, counting, sorting, and patterning. However,

[1]University of South Florida, USA.
[2]Correspondence should be directed to Elizabeth Ann Ethridge, EdD, University of South Florida; e-mail: ethridge@tempest.coedu.usf.edu

Teachers: Let's put it up on the Friday space. What day will it be tomorrow?

Class: Tomorrow will be Saturday, September 19th.

Teacher: Yes, what color do you think tomorrow's piece will be?

Child: It will be yellow.

Teacher: Who thinks it will be yellow? Who thinks it might be a different color? Can anyone find another Saturday and tell us its color?

Child: There's one above. It is yellow.

Teacher: Yes, that's right. You saw that all Saturdays are yellow. When you see something happening over and over again, it is called a pattern. Patterns can help you guess what will happen next. Let's look at tomorrow's piece...

This type of instruction is reminiscent of what DeVries and Zan (1994) describe as the Factory Model. In the Factory Model, the children usually rely on the teacher as Manager to tell them what to do at every step. The skills are likely to be isolated and arbitrary. According to DeVries and Zan, such activity often does not facilitate meaningful learning.

INFORMATION ON TIME, CALENDARS, AND TEACHING

The concept of time is ambiguous, socially constructed, and abstract. Elkind (n.d.) reminds readers of the stages of development that might be ascribed to young children's competence with time. Piaget has shown that children first use numbers (such as those on a clock face) in a nominal way, then ordinal, and finally through interval scales in their spontaneous attainment of measurement concepts. First is the notion of nominal numbers, which are acquired at 2 or 3 years of age. Ordinal numbers are acquired at ages 3 or 4. But it is the acquisition of interval scales that is required for arithmetic operations such as calendar work. Interval scales require children to have attained concrete operational stage, or at about ages 7–11. Children in preschool through third grade are in preoperational stage of development as defined by Piaget & Inhelder, 1969. Before they acquire concrete operations, children tend to reason transductively, or on the basis of contiguity. Transduction operates from object to object, or event to event. It does not allow for induction or deduction. Therefore, we view the underlying cognitive operations, claimed as outcomes for calendar math, with some skepticism.

In addition, preoperational children have difficulty focusing on more than one thing at a time. Consequently, only a rudimentary "cause and effect" is achieved by children in what Elkind labels "phenomenalistic causality, the idea that when two things occur together, one causes the other" (p. 2). Further, young children still retain some individualistic notions of learning practices as they develop what Elkind calls the fundamental curriculum (the knowledge of things, their special relations, their temporal sequencing). Because of these developmental characteristics, "it is not until the age of 7 or 8 that children have a good sense of clock time...[and] a true understanding of calendar time comes even later than that" (p. 3). As seen in the *Every Day Counts* example, a common skill covered in calendar math is the language label of yesterday, today, and tomorrow. While children may understand past time and future time, they often struggle with the labels of *yesterday* and *tomorrow*. For example, young children often make such statements as, "We're going to the pet store yesterday" or "My birthday was tomorrow". As Schwartz (1994, p. 105) noted, although young children "have a sense of temporal order of their experiences, they continue to struggle to order the sequences of both prior and future events and to comprehend the intervals of time that connect them". Rather, for preschool children a reality of time is its situatedness. "We play outside after we eat lunch. We have centers before group time. We have storytime after snack."

Without decentering, young children are unable to consider multiple meanings for a given sign, such as in place value. Kamii (1985) cautions that even as late as third grade, the majority of children do not grasp place value in mathematical reasoning. In their understanding of the numeral 16, children who are unable to decenter would have difficulty understanding that the one has two meanings: the number 1, and tens. When students are preoperational; can't yet decenter, and don't have conservation of number, abstract tasks such as place value will be difficult. Similar to place value, and more to the point of calendar math, each number has at least two purposes in calendar work. The number in a calendar square has a sequential meaning as the present exemplar in the succession of days. The number also has meaning as the marker for the current day of the week, as in "The fifteenth is Monday." As a result, each numeral has at least two exclusive and simultaneous meanings. According to Inhelder and Piaget (1958) young children are unable to deal with dual simultaneous symbol systems until they reach the stage of formal operations. Therefore, if the use of numerals in calendars is understood semiotically as an example of a second symbol system in the same time space, it is reasonable to expect children to have consistent difficulty in understanding.

Research and theorizing from the former Soviet Union appears to contradict some of the more subjective thinking about time sense development in the west. Leushina (1991) points out:

> Many children of six or seven cannot name the days of the week or the months in order, nor can they correlate the dates of familiar holidays with them. Similarly, they cannot correlate the months with the seasons of the year, nor do they know the casual relationship of the seasons (p. 146).
>
> Interestingly, Leushina also provides the very reasoning to support the constructive nature of time from a child's perspective. The relativity of time for young children (as well as adults) is conditioned by their interest in the present activity. "An activity that is interesting to the child passes faster, its duration seems not unnoticed, and the estimate of its objective duration decreases" (p. 147).

Nunes and Bryant (1996) also enter into an interesting discussion of the Piagetian notions of sequence, development, and stages. The relatively recent introduction of scaffolded instruction, based on Vygotskian theory, may have caused some controversy in terms of whether it is productive, inefficient, or harmful to teach, through direct teacher activity, mathematics concepts such the measurement of time before children are developmentally capable of understanding the concept. What is not controversial, according to Nunes and Bryant is that "children must grasp certain logical principles in order to understand mathematics" (p. 6). So that, if a teacher engages in scaffolded interaction to teach place value as part of calendar, a blend of reasoning from both Piagetian and Vygotskian philosophies would point to the futility and possible frustration in such an endeavor. Further, from our perspective, Nunes and Bryant respond from a "math privileged position." Children's individual constructions of "mathematics" are devalued in favor of a sequence of *the* way that math knowledge is sequenced by standardized curriculum.

Conservation is given a preeminence in the argumentation of Nunes and Bryant, "an essential form of understanding" (p. 6). Children without conservation will not understand the significance of number order, or the significance of cardinal numbers. General understanding in mathematics is impossible without conservation. "Children must understand conservation in order to know what they are doing when they count. Otherwise, they will simply be parroting the number words" (p. 7). The implications for time and calendar are immediate and from two stances. First, the basic knowledge of number is mediated by conservation competence and that same number knowledge is required for use on a calendar, as in a sequence of days, months, etc. Secondly, the notion of "parroting" is applicable to the students' responses to time and calendar-based questions posed by the teachers. Therefore, children may appear to "count" correctly, but they can do so without understanding the meaning of counting, nor be able to transfer the situated performance to other occasions that might require counting. Most importantly, according to Aubrey (2001, p. 194) children "...neither understand the significance of counting in order to deploy it effectively, nor appreciate the variety of situations in which counting can serve as an effective strategy for problem solving." In short, learning the "correct answer" does not necessarily indicate the students' understanding of the number (or time) construct that was in the mind of the teacher, a conclusion supported by Munn (1997). Despite our cautions that were derived from readings of research and theory, calendar math proves to be a popular, if not *required* activity in many K-3 classrooms. In fact, narratives of calendar math prototypes are available.

NARRATIVES OF CALENDAR TIME

Narratives of calendar math as it occurs in a kindergarten class can be recovered from Richgels's (2003) rich, year-long ethnography of Mrs. Porembra's kindergarten class. In Figure 2.2 (p. 19), Richgels provides a prototype for calendar centers. From left to right, the figure presents an "A.M." and "P.M." duty tree, an oversized monthly calendar with elapsed days alternately covered with apples and gingerbread men, a schedule for special subjects, and a weather forecast for the day. Across the top of the display, a sequence of 1 through 11, separated by dashes, with the numeral 10 circled.

On the last day of his study in the kindergarten, Richgels returns to the calendar time near the end of his book (pp. 305–308). In this single episode, Righels shows readers "calendar instruction" used by Mrs. Poremba for management of Jeff's off-task behavior, through his surprisingly correct response, and ultimately into the reasoning behind his correct answer. What is significant in this particular episode, and apparently surprising for Poremba (and Richgels) is that Jeff *does* know and proves it with an original algorithm. So the teaching that has been deployed all year in calendar time has not created the problem solution strategy in Jeff. He knows, but from his own resources. Because Jeff's path to the answer was not recognized and made explicit by the teacher, it cannot be considered strategic or transferable. Therefore, the path, (strategy) which is arguably the important learning, was not recognized. Further, the teacher's recognition of the correct answer provided by Jeff seems to displace any attention directed toward Jeff's use of strategy.

Another way to learn about the calendar's deployment in the early grades is to review the professional texts that are intended to prepare undergraduates for teaching careers with young children. Smith (1997) as well as Shaw and Blake (1998) caution their readers that nonphysical quantities such as time are measured differently than are physical objects. Measuring time involves duration. Citing research on first graders, Smith acknowledges that learning time, as in calendar math, in first grade is restricted to situated events and suggests that "recent investigations suggest that reflective teachers realize that children's understanding of time takes many (school) years to develop" (p. 164, elaborations authors'). According to Smith's cautions, time is situated and concrete for young learners. Further, children's acquisition of time is a prolonged trajectory. Therefore, it is curious to find the topic ubiquitously in early childhood curriculum.

More directly and more problematically, the field of early childhood appears to have conflicting values for calendar math. Consider the following examples. Charlesworth and Lind (1999) devote an entire chapter to the methods for teaching time and calendar to young children in a teacher directed format. Within a division of sequence and duration, the chapter stipulates key vocabulary as the Language of Time. Interview assessments are offered for both sequencing and clock knowledge. Naturalistic and informal methods are mentioned. Structured activities for teaching time are presented on 3 and ½ pages for a total of eight activities. The structure for the structured activities is Title, Objective, Materials, Activity, Follow-Up. The skills covered are sequence patterns, sequence stories, sequence activity, the first calendar, the use of the clock, beat the clock games, and discussion topics (for time vocabulary mastery). Yet, the chapter closes with "The young child learns his concept of time through naturalistic and informal experiences for the most part" (p. 225). In contrast, many researchers such as Seefeldt (2001) oppose instruction in calendar concepts for young children, preferring instead to teach in context. Yet, in another reversal Copley (2000), writing for the NAEYC, suggests that children in grades pre-K-2 should "recognize the attributes of length, volume, weight, area, and *time*" (p. 179, Measurement Standard, emphasis ours). Early childhood practice and theory appears to be conflicted regarding its understandings of and recommendations for teaching math and time concepts to young children.

IMPLICATIONS FOR FURTHER RESEARCH

Calendar math is a common if not universal practice in early education classrooms. It appears however, that many of the instructional intentions do not match with the cognitive development of children in the preoperational stage of development. Therefore, we are calling for a systematic inquiry into the everydayness of calendar math.

Calendar math does address several concepts that are both appropriate and valuable in a rich learning context for young children. For example, involving children in experiences with concepts such as patterning, sorting, and seriating can be beneficial in a meaningful, socially constructed learning context. Our concern is that these concepts are taught through teacher-directed, whole group instruction. Therefore, the opportunity for exploration, investigation, experimentation, and discovery by children is minimized if not deleted.

Our implication is that teachers need to reflect on practice. While it is important for teachers to do their work well (e.g. to be good at calendar math) it is also important to know well *why* you do what you do. In the case of calendar math, systematic reflection by a teacher on what she intended to teach should lead her to some conflict with what she believes about child development. A teacher who knows well about how young children learn, should be able to find other places to focus on constructs such as patterning, sorting, and seriating. In fact, teachers will likely realize they are already addressing such fundamental concepts in other parts of an integrated day.

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