

*A BRIEF REPORT ON A COMPARISON
OF TIME-SAMPLING PROCEDURES¹*

Much behavioral research has been based on an observation method in which an observer continuously time-sampled the occurrence of certain responses, typically making a notation of occurrence or nonoccurrence every 10 sec. Research and training settings often had the resources to allow such recording for every subject under study. Applied settings, by contrast, often could not afford an observer for every subject under study, and at present, even research and training settings find their funding inadequate for continuous time-sampling. Thus, intermittent time-sampling becomes necessary, and the question arises: how accurate is recording in each of the various possible patterns of intermittency? This brief report uses the teacher-training model to examine some quantitative comparisons.

In teacher training, especially in preschool settings, a number of subjects will probably be in each training analysis. Some subjects may be teachers being taught behavior-management skills; other subjects may be child-students in their classes, whose behavior is presumably changing as a function of the teachers' application of those behavior-management techniques. In the ideal case, one observer would continuously record each subject's rates of the management skills or other relevant behaviors. For the comparison to follow, it was assumed that such a sharply curtailed observer budget was in force that only one observer would be available to observe four subjects. Obviously, a quarter of the observer's total time could be assigned to each subject. The observer might be assigned to four teachers, or four children, or two teachers and two children—in other words, any four subjects (or any four behavior codes). Three possible patterns of such assignments are described; for convenience, these are based on a 64-min session potentially divisible into sixteen 4-min segments of observation. One simple and straightforward method, labelled *Contiguous*, would assign the first quarter of the period (16 min) to observation of Subject 1, the next

quarter to Subject 2, the third quarter to Subject 3, and the final quarter to Subject 4. This method, it might be supposed, would have the advantage of showing each person in action for the longest possible unbroken span of time. A second method, labelled *Alternating*, might assume that a more representative picture would result if quick alternations were made between relevant pairs of subjects, (e.g., a teacher and her child) but might still try to preserve some of the virtue of the contiguous method by alternating only between the members of the first pair (e.g., Teacher 1 and Child 1) for as long as possible, giving each a 4-min sample before turning to the other, for the first half of the time (i.e., for eight 4-min segments, or 32 min with 16 min given to each subject), and then repeating a similar pattern of alternation between the second pair (e.g., Teacher 2 and Child 2) for the second half of the time. A third method, labelled *Sequential*, might assume that the most widely dispersed pattern of sampling in all four subjects throughout the time would be most representative, and would systematically use each 4-min segment of the time to sample whichever subject had been sampled longest ago, thus rotating through Subjects 1, 2, 3, and 4, giving each a 4-min segment in every 16 min of observation. Each method has a certain logic to recommend it; the empirical question is, how closely does each method represent the actual behaviors of each subject as they would have been recorded throughout the hour without break (labelled Ongoing Recording in Figure 1).

To approach an answer to this question, repeated daily observations were made of two different behaviors of three different teachers. Each teacher was observed without break for at least 64 min, using the usual 10-sec ongoing time-sampling technique of earlier research (e.g., Baer and Wolf, 1967). A single, highly experienced observer made all of these observations. Another observer occasionally assessed reliability with the standard observer. Those segments of each teacher's records that would have been sampled under each of the three patterns described in Table 1 were then extracted from this Ongoing record, scored separately, and prorated as estimates of the teacher's rates during the total time of the Ongoing record (i.e., 64 min). The prorated estimates were then compared to the actual rates observed for each teacher through-

¹This project was funded through the Kansas Center for Research in Early Childhood Education in contract with the Central Midwest Regional Educational Laboratory, National Program in Early Childhood Education, and the Office of Education (Grant No. OEC 0-70-4125 607, subcontract NPECE—70-004).

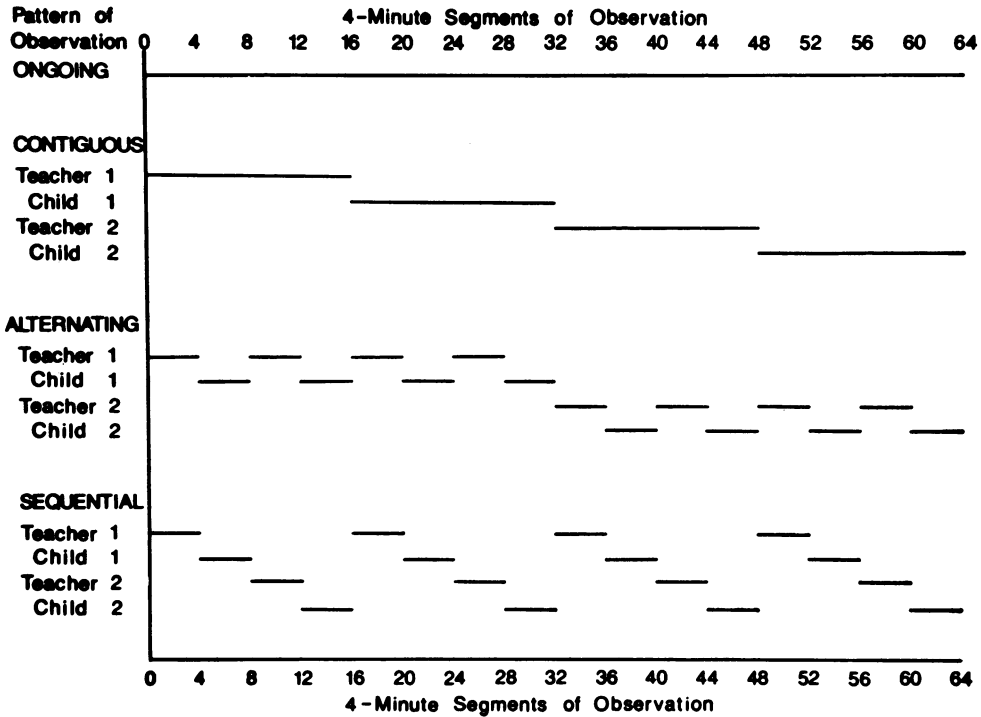


Fig. 1. The ongoing method of observation and the three intermittent time-sampling methods: Contiguous, Alternating, and Sequential.

out that same time. For each teacher, 13 to 22 days of observation (64 min per day) were considered. These days were drawn from much lengthier series of observations to represent both low and high rates of each behavior. (Days in which either teacher behavior was at zero rate were excluded.) Averages of those days' estimates were compared with the averages of those days' 64-min based Ongoing results, and the discrepancy was expressed as a percentage of the average of the 64-min based Ongoing results. These comparisons were made for each of the two different behaviors of each teacher. One behavior was her rate of reinforcing the subject's social interaction with peers; the other behavior was her rate of priming social interaction with peers (*i.e.*, prompting the child or other children to play together). The former tends to be a moderate-to-high-rate behavior in a preschool setting (especially after training); its occurrence reliability was assessed as 88% agreement. The latter ranges from very low to moderately low rates (even after training); its occurrence reliability was assessed as 87% agreement. Thus, the two behaviors are a reasonable sample of the rates that different teacher behaviors may have.

Figure 2 shows the average discrepancy (percentage of error along the ordinate) resulting from each method of sampling, expressed as a percentage of the average 64-min Ongoing observation of what was being sampled. For each of the three teachers, two be-

haviors are graphed: reinforcing peer interaction and priming peer interaction (on the abscissa). The average error in estimating the reinforcing-peer-interaction behavior by *Contiguous* time-sampling ranged from 25% to 50%; by *Alternating* time-sampling, it ranged from 18% to 48%; by *Sequential* time-sampling, from 1% to 38%. The average error in estimating the priming-peer-interaction behavior by *Contiguous* time-sampling ranged from 30% to 52%; by *Alternating* time-sampling, from 11% to 55%; by *Sequential* time-sampling, from 4% to 11%.

It is readily apparent that the *Sequential* method usually was associated with the smallest percentage of error. Direction of error (*e.g.*, over- or under-estimate) was ignored in computing the final percentage of error.

Possibly the *Contiguous* method of sampling was a less accurate estimate of actual behavior because the teacher's behavior changed over the daily time she was observed (64 min). She might be particularly sensitive to getting children to interact early in the period and thereby give them more attention than she is apt to do later in the same period. Possibly she is at her best, and thus more active with the children, earlier in the hour. And it may be that patterns of children's social interaction with peers vary with their interest, energy, and skills, when the opportunity to interact as one wishes is available in a free-operant setting. This, too,

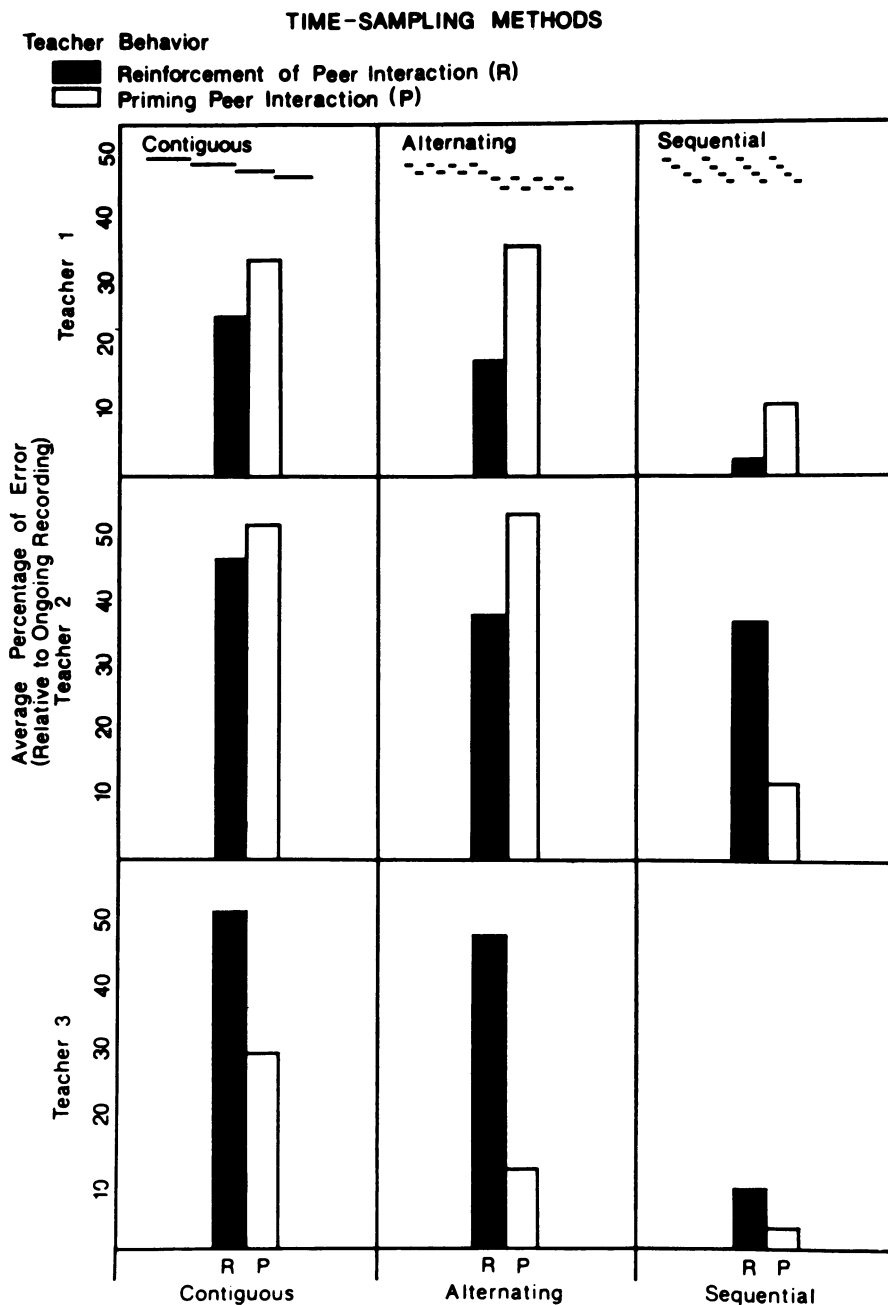


Fig. 2. The average discrepancy (percentage of error along the ordinate) resulting from each method of sampling expressed as a percentage of the average of 64-min ongoing observation results of what was being sampled for two behaviors: reinforcing peer interaction (R) and priming peer interaction (P) (abscissa).

might prompt a teacher to be more active at differing times of the period, thus making any one quarter an unrepresentative sample. The *Alternating* sampling method shows a similar amount of error for possibly the same reasons, because each of the two subjects sampled is seen only in either the first half or the last

half of the time. The *Sequential* time-sampling may be most accurate, simply because, of the three methods, it is the most widely dispersed sample of the entire observation period. Apparently, in this setting, it is better to sample the teacher briefly but repetitively over the time available (the *Sequential* method) than

to see her in action for the longest possible unbroken span of time (the *Contiguous* method), or to see her intermittently for only half of the time available (the *Alternating* method).

Carolyn Thomson
Department of Human Development
University of Kansas
Lawrence, Kansas 66045
Margaret Holmberg
Frank Porter Graham Child Development Center
University of North Carolina
Chapel Hill, North Carolina 27514

Donald M. Baer
Department of Human Development
University of Kansas
Lawrence, Kansas 66045

REFERENCE

- Baer, D. M. and Wolf, M. M. The reinforcement contingency in remedial and preschool education. In R. D. Hess and R. M. Baer (Eds.), *Early education: current theory, research, and action*. Chicago: Aldine, 1968. Pp. 119-129.

Received 7 November 1973.
(Revision requested 12 February 1974.)
(Final acceptance 21 August 1974.)