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INFLUENCING PRESCHOOLERS' FREE-PLAY ACTIVITY PREFERENCES: AN EVALUATION OF SATIATION AND EMBEDDED REINFORCEMENT

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The present study evaluated the effects of classwide satiation and embedded reinforcement procedures on preschoolers' activity preferences during scheduled free-play periods. The goal of the study was to increase time allocation to originally nonpreferred, but important, activities (instructional zone, library, and science) while continuing to provide access to all free-play activities. The satiation intervention applied to preferred activities resulted in increased time allocation to the instructional and science activities, the customized embedded reinforcement interventions resulted in increased time allocation to all three target activities, and high levels of attendance to the instructional and library activities were maintained during follow-up observations. Implications for the design of preschool free-play periods are discussed.

DESCRIPTORS: choice, embedded reinforcement, free play, preference assessment, preschoolers, satiation

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Free-choice or free-play periods are common preschool activities characterized by child-initiated engagement and social interaction (Bredekamp & Copple, 1997; Essa, 2003). Free-play periods provide children with opportunities to choose from a variety of simultaneously available activities that are presumably consistent with their interests and abilities (Allen & Schwartz, 2001) while providing opportunities to develop social and academic skills (e.g., incidental teaching is usually provided during free-play periods; Hart & Risley, 1975).

A recent descriptive study of preschoolers' free-play patterns showed that selection and engagement of materials in instructional, literacy, and science zones were consistently low compared to children's engagement in dramatic play, computers, blocks, manipulatives (e.g., table-top building toys), games, and art activities (Hanley, Cammilleri, Tiger, & Ingvarsson, 2007). Although a variety of skills may be developed when children are engaged in the latter set of activities, the classwide pattern of not selecting or engaging in instructional, literacy, or science activities is troublesome because early childhood researchers have emphasized the importance of exposure to books and science experiences as precursors to the development of literacy, mathematics, and problem-solving skills (Lawhon & Cobb, 2002; Malcom, 1998).

One strategy to promote selection of important but less preferred activities is to limit access to children's most preferred activities. For instance, limiting access to dramatic play, computers, and blocks might increase participation in other activities. A more acceptable alternative, which retains the preferred activities during free play, is to provide prolonged access

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to preferred activities in an attempt to decrease subsequent participation in those activities due to satiation or habituation (Murphy, McSweeney, Smith, & McComas, 2003). By decreasing the amount of time spent interacting with preferred free-play activities, such a procedure might also indirectly increase the amount of time spent in originally less preferred activities.

A more direct and potentially more acceptable strategy would be to focus on increasing the relative value of the originally less preferred activities. Cammilleri and Hanley (2005) recently described a strategy to increase the variety of classroom activity engagement. Extra teacher interaction was provided when children selected activities that were different from those they had selected during previous choice opportunities. This arrangement was successful in promoting varied activity selections with 2 children who had previously displayed stereotypic activity selection during free play. Although this strategy promotes varied activity selections, it does not necessarily increase time allocation to specific activities.

Embedding highly reinforcing materials or interactions in selected activities is an alternative strategy for promoting engagement in those activities. This strategy has been applied to adults with disabilities to alter preferences for both table-top leisure activities (e.g., puzzles, drawing, sewing; Hanley, Iwata, Roscoe, Thompson, & Lindberg, 2003) and protracted leisure and work activities (e.g., playing basketball, riding a bike, washing dishes; Hanley, Iwata, & Lindberg, 1999). However, the use of embedded reinforcement to redirect activity choices within groups of preschoolers has not yet been evaluated.

The purpose of the present study was to determine (a) the types of free-play activities that children selected and engaged in most and least frequently and (b) the independent effects of satiation and embedded reinforcement on the percentage of time children spent engaged in various free-play activities.

METHOD

Participants and Setting

Observations were conducted during free-play periods in a full-day university-based preschool classroom serving 20 children of both typical and atypical development (12 boys and 8 girls) between the ages of 3.5 to 5.5 years. Three children had been diagnosed with nonspecified developmental delays. The classroom measured 12 m by 7 m (see Hanley et al., 2007, for a schematic of the classroom). Three free-play periods were scheduled throughout the day in which nine activity areas were available simultaneously. Children selected a wooden magnetic letter from an easel located in the center of the room and placed the letter on a small magnetic square in the corresponding activity zone to access an activity. Each zone had a limited number of letters available, such that teachers would redirect children to select a different letter if no additional letters were available in a given zone. Children could switch areas at any time by replacing their letter on the central letter board and selecting a new letter. Descriptions of each activity zone and the corresponding number of available letters (i.e., the capacity of the zones) are presented in Table 1. The classroom was staffed by four undergraduate practicum students and a graduate student supervisor.

Measurement and Interobserver Agreement

One or two observers sat unobtrusively near the side of the room and collected data using pencil and paper. Children's time allocation to each of the nine activity areas was measured simultaneously during 18-min sessions using the momentary time-sampling procedure described by Hanley et al. (2007). A different child was observed every 4 or 5 s, such that each child was observed once every 90 s. For example, Jenny was observed at Second 5 and at Second 95, Billy was observed at Second 10 and again at Second 100. These observations resulted in 12 scored intervals for each child per

Table 1
Activity Area Descriptions

Activity	Capacity	Description
Dramatic play	4	Pretend play toys (e.g., dress-up clothes, doctor set, flower shop, barber shop)
Computer	2	Two computers with a variety of CD-ROM games (e.g., Clifford's Counting, Jumpstart Kindergarten)
Blocks	4	Toys to occasion large motor movement (e.g., train sets, large blocks, bowling set, basketball)
Manipulatives	4	Small toys on table tops to occasion small motor movement (e.g., building blocks, animals, tinker toys, Lincoln Logs)
Games	3	Age-appropriate board games and large puzzles (e.g., Candyland, Memory, dominos)
Art	4	Open-ended art activities on table top (e.g., paint, crayons, Play-Doh)
Science	3	An open-ended activity for children to explore and use their senses (e.g., digging for dinosaurs in sand; pouring water through sieves)
Instructional zone	2	One-on-one direct instruction. Each child had individualized skills and relevant materials selected and stored in the area
Library	3	A variety of age-appropriate books
Out of zone	20	Not in the proximity of any of the nine programmed activities (e.g., selecting a letter, in the bathroom area, or wandering)

Note. This table was reproduced from Hanley et al. (2007).

session. *In zone* was scored when the child was observed within approximately 0.3 m of the materials in one of the nine activity areas. Observers coded a single letter corresponding to one of the nine activities or out of zone in each interval. In-zone scores were determined for each classroom activity for each child. If children were engaged with the materials, defined as touching or orienting towards the materials, observers circled the previously recorded in-zone letter. Because children were found to be engaged in over 90% of the intervals in which they were scored as in a zone, only in-zone percentages will be reported.

To determine the entire class in-zone percentage for each activity area (Figure 1), the number of intervals scored in each area for all children was divided by the maximum number of intervals, which varied depending on the capacity of the zone. Individual children's in-zone percentages were determined by dividing the number of intervals each child was located in each zone by the total number of intervals each child was observed. The mean number of children observed each day was 12 (range, 7 to 17); neither high nor low numbers of children were correlated with any particular condition, and no data were omitted throughout the analysis.

A second observer simultaneously but independently scored in zone and engagement during 35.3% of sessions across all conditions. Observers' records were compared on an interval-by-interval basis and were scored in agreement if both scored the same activity and, separately, if both agreed that the child was engaged. The number of intervals scored in agreement was divided by the total number of intervals scored and converted to a percentage for each session. Mean agreement was 97% (range 92% to 100%) for in zone and 98% (range, 93% to 100%) for engagement.

Procedure

Baseline. Materials in each of the activity areas were rotated according to a predetermined schedule. Dramatic play, blocks, art, games, manipulatives, and science materials were rotated daily. Because of the large number of options (e.g., books) in the library and the individualized nature of the instructional zone, the materials in these activities were rotated weekly. A wide variety of computer games on compact discs (CDs) were located by the computer; therefore, these materials did not rotate. During each free-play period, teachers welcomed children to the different activity areas and moved between areas to assist children in starting activities.

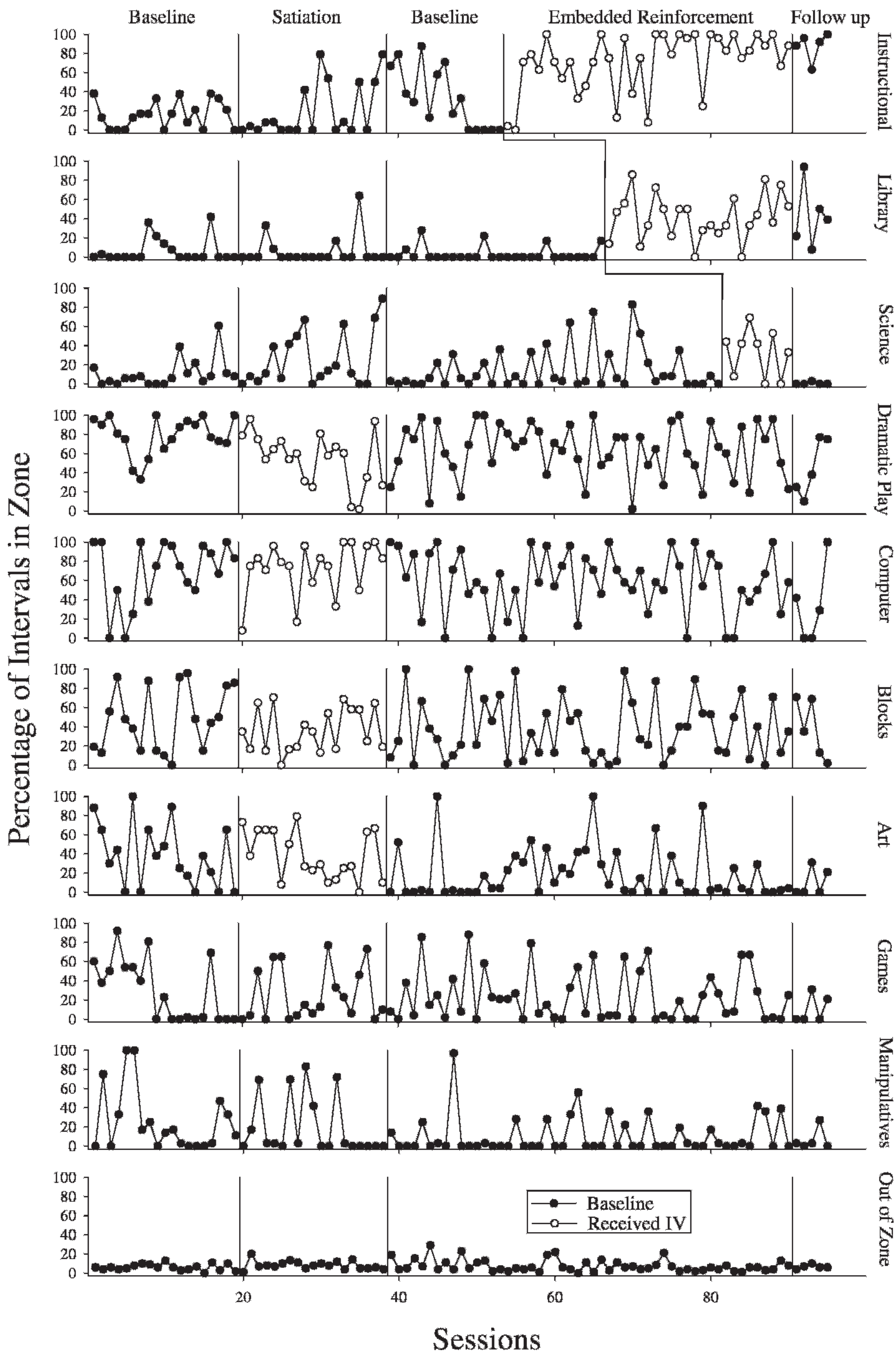

Figure 1. The percentages of intervals in zone for the entire class are shown for each activity during baseline, satiation, and embedded reinforcement conditions.

Satiation. Materials in dramatic play, art, and blocks were held constant during this condition and all but two CDs were removed from the computer area. The materials that remained in these areas were those that occasioned the highest levels of in-zone and engagement percentages during baseline; office materials (e.g., phones, calculators, paper, tape) remained in the dramatic play area, Play-Doh remained in the art area, plastic farm animals and Legos remained in the blocks area, and Blues Clues and Jumpstart Preschool remained in the computer area. Materials in the remaining areas continued to be rotated according to the typical schedule. The materials noted above were available in the dramatic play, blocks, and art activities during 5%, 10%, and 13% of sessions during baseline, respectively. By contrast, these materials were present during 100% of sessions during the satiation phase. The two computer games were available continuously during all phases of the study, but the alternative games were available during 100% of baseline observations and 0% of observations during satiation. The effects of the satiation procedures were evaluated in a reversal design.

Embedded reinforcement. The effects of embedding reinforcement in originally less preferred activities (i.e., instructional zone, library, and science) were evaluated by sequentially introducing embedded reinforcement in a multiple baseline design across activities. Teachers and experimenters worked together to make changes to the less preferred areas that would likely promote selection of and engagement in these areas. In the instructional zone (a) the chairs and cubbies of the instructional zone were redecorated with popular children's cartoon characters; (b) teachers reviewed and discussed the essential features of differential reinforcement and errorless prompting during instruction; (c) when possible, a teacher sat in the instructional zone prior to children selecting the instructional zone; and (d) small trinkets (rubber insects) and, occasionally, edible items (a small piece of chocolate) were placed intermittently in each child's bin of individualized instructional materials, which were available to children who selected and sat in the instructional zone (one item was placed in a each bin every other day). The library area was enhanced by (a) removing a table and chairs and placing four plush pillows and a carpet in the library; (b) selecting a book of the week and displaying the book on a stand with thematically related toys (e.g., small tractors to go along with a book about construction); and (c) when possible, a teacher sat in the library prior to children selecting the area. Science-related activities that were thought to provide more reinforcement were arranged in the science area. To increase the likelihood that children would select the science area, teachers presented each new science activity during group instruction (scheduled circle or learning-center periods) the day prior to its inclusion in the science area. During group instruction, the teacher modeled appropriate play, prompted children to engage in the task, and provided feedback. Examples of the improved science activities are provided in Table 2 (see Charner, 1998, for more examples).

Follow-up. Follow-up observations were conducted once weekly following completion of the embedded reinforcement phase. The embedded materials remained in the classroom and teachers were taught to select a weekly library theme and preview science activities during circles and learning centers.

RESULTS

In-zone percentages for the entire classroom of children across the 10 activities are shown in Figure 1. The three activities with the lowest in-zone percentages during the initial baseline were the instructional zone (M = 16%), the library (M = 7%), and the science zone (M = 11%). These activities also were associated with the lowest in-zone percentages during the descriptive observations from Hanley et al. (2007).

Table 2
Improved Science Activities

1.	Children were provided with magnets to determine which of a variety of objects (e.g., cars, balls, paper clips) were magnetic. A chart was provided so they could mark a picture of each object with a magnet or an X.
2.	A water table was filled with water, funnels, containers, and different designed ping-pong balls (e.g., baseball, basketball, tennis, and plain). Children scooped the balls with the funnel and sorted them into separate containers.
3.	Several microscopes were available with slides containing various insect body parts (e.g., butterfly wings, ants, antennae).
4.	A variety of plastic insects and cards with matching pictures were available. Children matched insects with their picture card.
5.	Synthetic rubber worms and insects were placed in water.
6.	Test tubes were filled individually with various substances (e.g., oil, colored water, glitter, confetti).

Because the instructional, library, and science zones were associated with the three lowest mean in-zone percentages, and because these activities provided rich opportunities to teach children early academic skills, these activities were selected as targets of intervention (and are located at the top of Figure 1). The remaining activities are shown in order of highest to lowest mean in-zone percentages during baseline. Also consistent with Hanley et al., dramatic play ($M = 79\%$), computer ($M = 68\%$), and blocks ($M = 48\%$) were the three most preferred activities during the initial baseline.

The satiation procedure appeared to result in a slow decline in allocation to dramatic play ($M = 55\%$), a decrease in the overall in-zone level for blocks ($M = 36\%$), and no changes in the in-zone measures for computer ($M = 72\%$) or art ($M = 39\%$). The indirect effects of the satiation procedure were higher in-zone measures for the instructional ($M = 20\%$) and science ($M = 26\%$) zones relative to baseline; however, no increase was observed for the library ($M = 6\%$). A reversal to baseline resulted in a gradual return to zero levels for the instructional zone and an immediate reduction to near-zero levels for the science zone.

Following 15 baseline observations, putative reinforcers were embedded into the instructional zone. This change resulted in a sustained increase in attendance to this area ($M = 72\%$). Following 28 baseline observations, putative reinforcers were embedded into the library, and an immediate and sustained increase in attendance to this area was observed ($M = 41\%$). In-zone percentages for the science zone were variable throughout the 43 baseline observations ($M = 15\%$) but remained near zero towards the end of the phase. When putative reinforcers were embedded into the science zone, an immediate increase to moderate levels was observed ($M = 32\%$), although there was significant overlap with levels observed during baseline.

At follow-up, in-zone percentages for the instructional zone and the library remained at postintervention levels ($M = 88\%$ and 43%, respectively), while in-zone percentages for the science area decreased to near-zero levels ($M = 0.6\%$).

The mean percentage of intervals each child was observed in any of the three target zones during the last five sessions of the initial baseline, satiation condition, baseline return, and embedded reinforcement condition was calculated to determine the intervention effects for individual children. Thirteen of the 20 children were observed in a target zone more often during the satiation phase relative to the initial baseline phase. Sixteen of the 20 children were observed in a target zone more often during the embedded reinforcement phase relative to the preceding baseline phase. Overall, there was a just under a twofold increase and just under a sixfold increase in time allocation to the target zones during the satiation and embedded reinforcement conditions, respectively.

DISCUSSION

The present study evaluated the effects of classwide satiation and embedded reinforcement procedures on preschoolers' activity preferences during regularly scheduled free-play periods. The goal of the study was to increase time allocation to originally nonpreferred, but important, activities while continuing to provide access to all free-play activities. The satiation intervention resulted in increased time allocation to two of the three target activities (instructional and science zones), whereas customized embedded reinforcement resulted in increased time allocation to all three targeted activities. High levels of attendance persisted for two of the three target activities (instructional zone and library) during follow-up observations.

Initial baseline observations were consistent with those reported in Hanley et al. (2007) in that dramatic play, computer, and blocks were the most preferred activities and the instructional zone, library, and science zones were the least preferred. The consistency of the results is not surprising considering that both observations occurred in the same child-care setting, albeit with a different cohort of children and teachers. Future research should evaluate time allocation during free-play periods using a similar measurement system in different child-care settings with children of different ages to determine the generality of the preference hierarchy. These hierarchies may satisfy more than a casual curiosity of parents and teachers regarding their children's preferences for preschool activities. If results suggest that, in general, children are not exposed sufficiently to the wide range of learning opportunities provided in early care settings, then changes in the existing rotation schedule or quality of the free-play activities should be considered.

Satiation interventions may be effective in disrupting exclusive preferences for popular activities and indirectly increasing time allocation to other activities. Only a modest effect of our satiation procedure was evident by the downward trend in the in-zone measures for dramatic play and the delayed increases in the in-zone measures for the instructional and library areas. A more fine-grained analysis of the data, which showed increased contact with dramatic play, a gradual decline in time with that activity, and a subsequent increase in time with the instructional and library areas, would be necessary to attribute these changes to a satiation operation with confidence. However, due to the restriction on the number of children in each zone and the ceiling on our measurement system, this sort of analysis is not possible in the current study. An alternative conceptualization is that the repeated presentation resulted in habituation to the dramatic play materials (Murphy et al., 2003). In addition to conceptual issues with our satiation intervention, there is also a practical concern; that is, the satiation (or habituation) procedure does not guarantee that a child will reallocate his or her time to a particular activity. For example, children who are repeatedly exposed to dramatic play may allocate more time to the block area while other activities may remain unattended. By contrast, teachers can increase the likelihood that children will attend particular activities by embedding reinforcers in those activities.

High levels of attendance and engagement persisted for the instructional zone and the library during observations that followed the embedded reinforcement conditions. The same was not true for the science zone. Casual observation of the science area during follow-up suggested that the teachers did not continue to plan or include novel or dynamic science activities, such as those used during the embedded reinforcement phase. Although the specific variables that influenced increased time allocation to the instructional zone and the library were not determined, it seems as though most of the materials added to these zones were fairly permanent (e.g., carpet, pillows, seat cushions with colorful icons) or required only weekly, as opposed to daily, alterations (e.g., theme book of the week, individualized curriculum materials). By contrast, the science area involved the selection and setup of a different activity each day and daily exposure to that activity during circle or center times. Thus, the effort involved in maintaining attendance to the science zone may have far exceeded that required for the other zones. In addition, it is likely that we did not provide teachers with sufficient examples of dynamic science activities, and that we failed to arrange effective consequences for teachers to maintain high-quality material selection. Future research is needed to identify strategies that will result in sustained selection of and engagement in science activities in preschool classrooms.

Although the effects observed under the embedded reinforcement contingencies were fairly robust, there were individual children for whom no effects were observed. There are several augmentative strategies that could be evaluated in future research to enhance these effects. For example, activity sampling, in which children are provided with brief access to activities, would expose children to reinforcers associated with a particular activity and thus may increase the likelihood that children would return to the area (Ayllon & Azrin, 1968). Activity sampling could be achieved through direct teacher prompts to attend various activities. Alternatively, procedures that reinforce children's selections of diverse activities (Cammilleri & Hanley, 2005) could be implemented intermittently (e.g., once per week) to ensure exposure and activity sampling. The putative reinforcers arranged for the three target areas may not have served as functional reinforcers for all children. If so, individualizing reinforcement contingencies by conducting preference assessments (e.g., Fisher et al., 1992) with individual children might improve the effectiveness of embedded reinforcement. Finally, there may be conditions in which simply restricting access to highly preferred activities or directly prompting selection of less preferred activities are reasonable alternatives.

Children's free-play patterns may be viewed on a continuum with two undesirable endpoints. At one end, children may play exclusively with a single activity over long periods of time, thereby missing opportunities to develop varied skill repertoires (Cammilleri & Hanley, 2005). At the other end of the continuum, children may interact only briefly with a wide variety of activities, failing to develop complex skill repertoires through persistent engagement with particular activities (Jacobson, Bushell, & Risley, 1968). Although ideal patterns of time allocation among free-play activities are not yet known, the techniques to promote changes in the distribution of engagement described in the current study as well as those from Jacobson et al. and Cammilleri and Hanley can be applied in preschool classrooms to transition from either end of the continuum. An important direction for future research would be to determine if changes in patterns of time distribution produce corresponding improvement in measures of progress in important developmental domains.

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