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Brief Note

Physical Arrangements and Staff Implementation of Function-Based Interventions in School and Community Settings

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The present study examined effects of changes in physical arrangements on staff implementation of function-based interventions. An adolescent with autism who frequently bit his hands, 5 school teachers, and 5 community support center staff participated. First, a functional assessment revealed that in the school task setting, the student's hand biting might have an escape function, whereas it appeared to have attention-getting or sensory stimulation functions in free-time settings at the school and community support center. A multiple baseline design across 3 settings was used. In baseline, occurrences of the student's hand biting and staff implementation were observed. During the function-based intervention (FI), staff in each setting were asked to implement function-based interventions. In the function-based intervention with physical arrangements (FIP) condition, the physical environment was re-arranged to encourage the student's desired behavior in the function-based intervention. The results showed that in all 3 settings, the student's hand biting decreased more during the function-based intervention with physical arrangements than during the function-based intervention alone. Also, staff implementation increased more during the former than during the latter. The results were discussed in terms of a proactive strategy for promoting staff implementation of function-based interventions.

Key Words: behavior problem, function-based intervention, staff implementation, physical arrangements, adolescent with autism

Introduction

Recent research in applied behavior analysis has shown that function-based interventions can be effective for addressing behavior problems in students with developmental disabilities (e.g., Ingram, Lewis-Palmer, & Sugai, 2005; Tasse, 2006). Function-based interventions incorporate both functional assessment and an intervention (Carr, Langdon, & Yarborough, 1999). Functional assessment is a process of

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data collection used to derive hypotheses about the functional relationship between the environment and the behavior problems (O'Neill, Horner, Albin, Sprague, Storey, & Newton, 1997). Based on the hypothesis, multi-component interventions are developed to prevent behavior problems by manipulating antecedent events and consequences, and to build replacement desired behavior or communication skills (O'Neill et al., 1997).

Function-based interventions, by their nature, may require staff to change their own behavior that is associated with a students' behavior problems. However, staff do not always find it easy to change their behavior, due to various factors in everyday settings. Thus, a series of studies has been appearing that promotes staff implementation of function-based interventions in order to achieve effective interventions. One focus has been on training staff to increase procedural fidelity in school or community settings (e.g., Kern, Gallagher, Starsosta, Hickman, & George, 2006). Another focus has been the social collaboration process affecting staff implementation, such as sharing values, communication, problem solving, and conflict resolution (e.g., Bambara, Gomez, Koger, Lohrmann-O'Rourke, & Xin, 2001; Snell, Voorhees, & Lih-Yuan, 2005).

Research has indicated that the physical arrangement of a classroom could affect both students' and staff's behavior (e.g., Kern & Clemens, 2007; Stewart & Evans, 1997). A well-arranged physical environment, including the classroom layout, location of materials, and seating, may promote students' desired behavior and prevent behavior problems. Thus, staff can manage instruction effectively.

In research on communication training, the physical environment has been arranged to induce students' communication responses by not having preferred items available on a shelf (e.g., Fujiwara, 1985; Nagasawa & Morishima, 1992). If an arrangement of the physical environment promotes students' desired behavior or communication skills, staff can then implement function-based interventions effectively. As a result, students' behavior problems would decrease.

To date, however, it has not been confirmed as to whether a physical arrangement would affect staff implementation of function-based interventions. Especially, virtually no studies have measured staff implementation (Snell et al., 2005).

The aim of the present study was to examine the effect of physical arrangement on staff implementation of function-based interventions. The issue in the research was to determine whether or not staff implementation of function-based interventions would be more extensive with a changed physical arrangement compared to an unchanged environment, and whether reduction of students' behavior problems would be functionally related to the extent of staff implementation.

Method

Participants, Study Period, and Settings

A 16-year-old male student with a diagnosis of autistic disorder participated in the present study. He attended a special support school. His overall score on the

Tanaka-Vineland intelligence test was 35. He had no functional vocalization. He could respond to familiar verbal commands. At school and at the community support center for his short-time care after school, he exhibited frequent hand biting.

The present study was conducted from July 200x to February 200x+1, during school tasks and free-time at school and at the community support center.

Five school teachers and five support staff at the community support center who were in charge of the student participated. In what follows, both the teachers and the community support center staff as referred to as "staff".

In the school task setting, three staff were in charge of the student for a 45-minute vocational task, with a total of 10 students 4 times a week. Two of the staff were alternately with him in the task setting. In the school free-time setting, two homeroom staff alternately played with him or other students in the play room during a 20-minute free-time period after lunch every day. In the community support center setting, five staff were alternately involved with him or other children for a half hour twice a week.

Procedures

General procedures. The present study was conducted in collaboration with staff in response to a request from the school and community support center. The first author, who consulted on developmental disabilities at a university, visited the school and community support center once a week, conducting functional assessments, and developing hypotheses and a general intervention plan. Staff clarified procedures that were feasible and which they could implement in each setting.

Function-based intervention development. Prior to baseline, functional assessment was conducted in each setting in order to develop hypotheses regarding environmental events that might be associated with the student's hand biting. A functional assessment interview (O'Neill et al., 1997) suggested a hypothesis. Subsequently, direct ABC (Antecedent, Behavior, Consequence) observations and analysis validated the hypothesis. Based on the hypothesis, interventions were developed for each setting (see Table 1).

In the school task setting, during the paper craft task, the student was likely to engage in hand biting when staff encouraged him repeatedly, and he sometimes was not engaged in the task. When he bit his hand, the staff discontinued the encouragement and gave him a break. This suggests that, in this setting, the student's hand biting might have helped him escape from the task. Therefore, antecedent interventions planned to prevent hand biting included changes such as reducing staff encouragement and decreasing the requirements of each task. Procedures for consequences were planned to reinforce task engagement, including praising engagement and providing him with preferred activities (such as leafing through a book) after he completed the task and had not bit his hand.

In the school free-time setting after lunch, when staff paid little attention to him and the student had nothing to do, he was likely to engage in hand biting. Then, staff tried to stop him and interacted with him for a while. Sometimes he bit his hand when

TABLE 1 Function-Based Interventions in Each Setting

Setting	Antecedent	Target behavior	Consequence
School task setting			
hypothesis:			
	paper craft task repeated encouragement	hand biting	get escape from task
interventions:			
	1 reduce encouragement 2 reduce the amount of each task	task engagement	3 praise for engagement 4 provide preferred activity at the end of task 5 not getting involved in hand biting
School free-time setting			
hypothesis:			
	less staff attention nothing to do	hand biting	get staff attention get self stimulation
interventions:			
	1 arrange preferred play materials 2 give student preferred material 3 encourage play using his hand	play together	4 interact individually for a while 5 not getting involved in hand biting
Community support center setting			
hypothesis:			
	less staff attention nothing to do	hand biting	get staff attention get self stimulation
interventions:			
	1 arrange preferred play materials 2 give student preferred material 3 promote play at the beginning	play together play alone	4 interact individually for a while 5 not getting involved in hand biting

he was by himself with no one else there. This suggests that, in this setting, by biting his hand, he might catch a staff member's attention or obtain sensory stimulation. Therefore, to get the attention of staff and find him something else to do through play, antecedent interventions were planned such as arranging preferred play materials (e.g., a book, a jump rope, a bottle with a decoration), so as to give the student these materials and encourage him to play using his hands. Interventions for consequences were planned to reinforce appropriate play, interacting with him individually for a while when he approached staff and was not biting his hand.

In the community support center setting, also when there was less interaction with staff and nothing to do, the student might get the staff's attention and obtain sensory stimulation by means of his hand biting. Although the procedures were quite similar to the school free-time procedures, one staff member had to take care of the other students the whole time. Antecedent interventions were planned only at the

beginning, such as to arrange preferred play materials and promote play.

Baseline. The student's hand biting and staff implementation in each setting were observed. Staff were instructed to respond to the student's hand biting as usual.

Function-Based Intervention (FI). Staff were instructed to implement function-based interventions in each of the settings as described above (see Table 1).

Function-Based Intervention with Physical Arrangement (FIP). The physical environment was re-arranged in each of the settings, in order based on the analysis of his performance during the function-based interventions, in order to promote the student's desired behavior. The first author presented the plan, explaining that it would make it easier for the student to perform desired behavior and get consequences for not biting his hand. Staff finalized the plan in light of feasibility and its impact on other students.

In the school task setting, in order to promote the student's task engagement without the necessity of constant staff encouragement, the task materials and the student's seat were arranged so as to clarify the task sequence, the completion of each part of the task, and the predictability of preferred items at the completion of the task. The staff sat where they could avoid encouraging him unnecessarily (Fig. 1).

Although the free-time setting at the school and community support center were

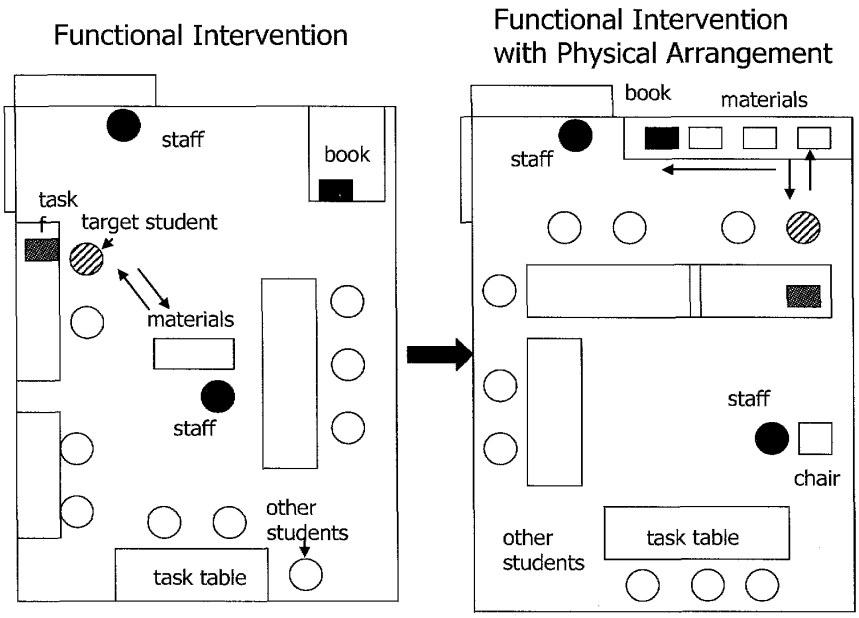

FIG. 1 Physical Arrangement in the School Task Setting

Notes. ▨=target student, ○=other students, ●=staff.

During the functional intervention, the target student went back and forth from his seat to the center of the room to get materials. The staff had to go around him. During the functional intervention with physical arrangement, the target student moved through the sequences of the task, and the staff sat elsewhere in the room.

different in physical layout, the arrangements for the intervention were made similarly, in order to promote the student's access to staff and play, including a shelf with preferred play materials and a mat (Fig. 2). Play materials were not to be made freely available to the student. Rather, staff sat on a mat in front of the shelf where the materials were kept, in order to be ready to give the student play materials and to promote play with him on the mat.

Measurement

The student's hand biting and staff implementation of the interventions were measured. The student's hand biting was defined as moving his hand to his mouth or biting it. Staff implementation was defined as implementation of the function-based interventions (see Table 1).

Data were collected by videotaped observation or direct observation once or twice a week. The student's hand biting was measured by 1-minute-interval recording by the first author or by two undergraduate students who had studied behavior analysis for two years. The percentage of hand biting was calculated as the number of occurrence intervals divided by the number of all intervals times 100. Staff implementation of each procedure was measured by staff on a three-point evaluation scale (see Table 1): 0, none; 1, sometimes; 2, almost always. Staff implementation percentage was calculated as points scored divided by the total possible points of the planned interventions times 100. For example, in the school task setting, if the points

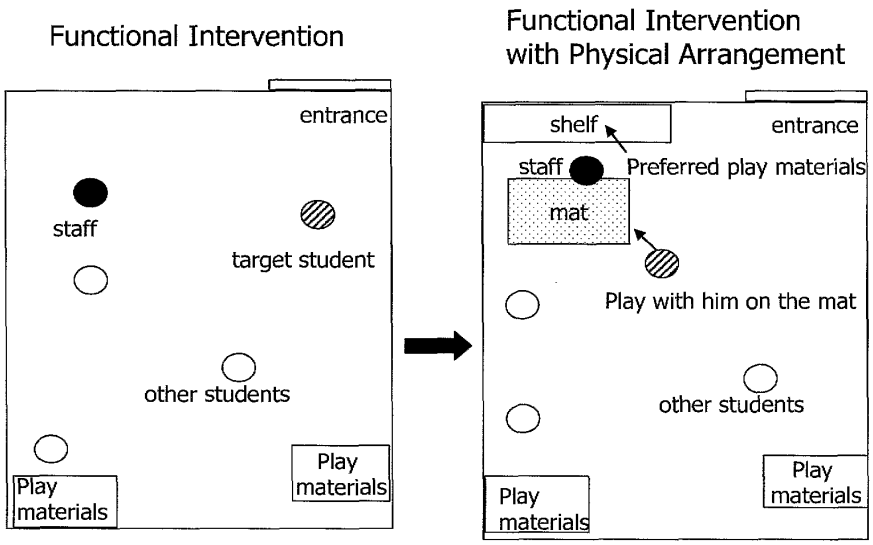

FIG. 2 Physical Arrangement in the School Free-Time Setting

Notes. ▨ = target student, ○ = other students, ● = staff.

During the functional intervention, the target student walked around freely. During the functional intervention with physical arrangement, when the student approached the shelf where his preferred materials were kept, staff gave him the materials and then played with him.

scored were 5 in 5 planned interventions, then those 5 points divided by 10 (5 planned interventions times 2, the maximum number of points for each) times 100 results in a measure of 50% implementation.

To analyze the data, a multiple-baseline design across three settings (Kennedy, 2005) was used. The student's hand biting and staff implementation were compared for each condition.

Reliability

Interobserver agreement was assessed for the videotaped sessions, which was 30% of all sessions. Although staff implementation was mainly self-recorded, some sessions was videotaped. These then were evaluated in order to assess the reliability of the staff's scoring. The observers were the first author, third author, and the two undergraduate students described above. Reliability of the records of the student's hand biting averaged 80%. Reliability of staff implementation averaged 80%.

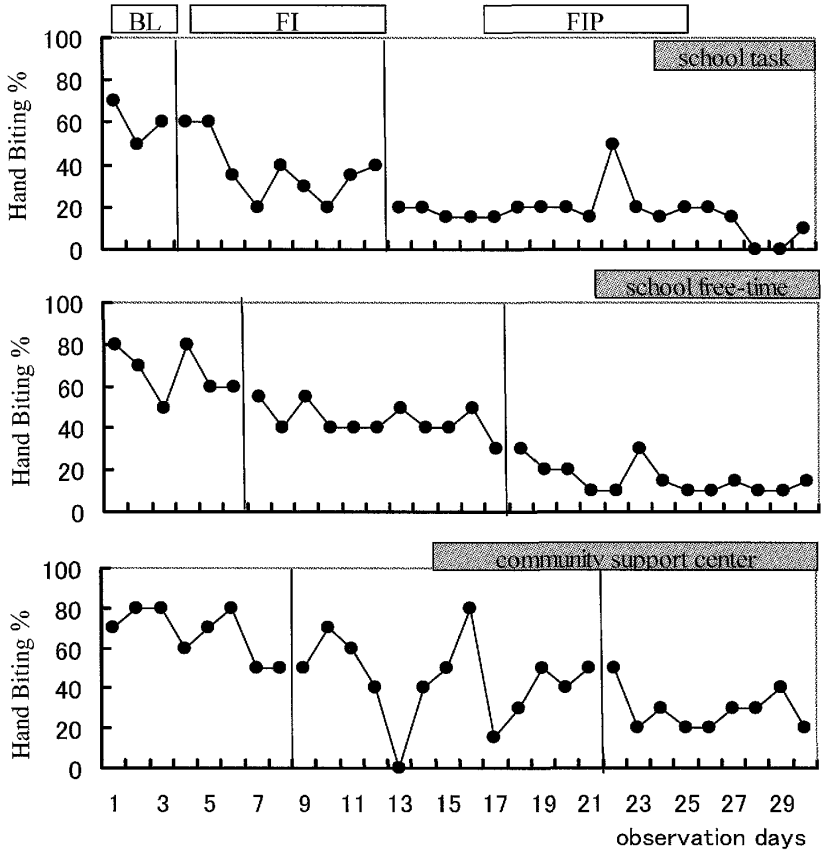

FIG. 3 Percentage of Intervals in Which the Student Bit His Hand in the Three Experimental Settings

Notes. BL=baseline; FI=functional intervention; FIP=functional intervention with physical arrangement.

Results

Student's Hand Biting

Figure 3 displays the percentage of intervals in which the student bit his hand in the three settings under all experimental conditions.

In the school task setting (upper panel of Fig. 3), the student's hand-biting averaged 60% in baseline, 37.8% during the functional intervention, and 17.2% during the functional intervention with physical arrangement. In the school free-time setting (middle panel of Fig. 3), his hand biting occurred on an average of 66.7% at baseline, 43.6% during the functional intervention, and 15.8% during the functional intervention with physical arrangement.

His hand biting occurred at a relatively higher rate on the 22nd observation day, when the student bit his hand before the task activities and continued that to some extent.

In the community support center (bottom panel of Fig. 3), he bit his hand on the average in 67.5% of observation intervals in baseline, 44.2% during the functional intervention, and 28.9% during the functional intervention with physical arrangement. On the 13th and 17th days, a relatively lower rate of hand biting occurred for no identifiable reason.

In all settings, the amount of hand biting was reduced during the interventions relative to the amount during the baseline period. Also, during the functional intervention with physical arrangement, the level of occurrence was reduced relative to the amount during the functional intervention period.

In the community support center setting, although the average percentage of hand biting during the functional intervention was lower than during baseline, the rate of hand biting was variable across observation days.

Staff Implementation

None of the function-based interventions was implemented by the staff during baseline in any of the settings.

Table 2 displays the average percentage of staff implementation of the function-based interventions. Staff implementation during the period of functional intervention with physical arrangement was higher than during the functional intervention period. In the community support center setting, implementation was especially variable during functional intervention, but implementation was constant during functional intervention with physical arrangement.

Detailed analysis across procedures revealed that some kinds of procedures, e.g., reducing encouragement, interacting individually, and not becoming involved in hand biting, tended not to be implemented during the functional intervention. However, these procedures increased in the period of functional intervention with physical arrangement.

There were no major differences across individual members of the staff.

TABLE 2 Average Staff Implementation in Functional Intervention and Functional Intervention With Physical Arrangement Periods

Intervention		FI	FIP
School task setting average % (range)		55.6 (50-70)	76.1 (50-90)
1	reduce encouragement	16.7	58.3
2	reduce the amount of each task	94.4	94.4
3	praise for engagement	94.4	94.4
4	provide preferred activity at the end of task	61.1	77.8
5	not getting involved in hand biting	11.1	58.4
School free-time setting		49 (30-70)	67.7 (50-80)
1	arrange preferred play materials	72.7	92.3
2	give student preferred materials	59.1	80.8
3	encourage to play using his hand	54.5	50
4	interact individually for a while	45.5	69.2
5	not getting involved in hand biting	9.1	46.2
Community support center setting		48.5 (10-80)	77.8 (70-80)
1	arrange preferred play materials	80.8	94.4
2	give student preferred materials	57.7	94.4
3	promote play at the beginning	53.8	72.2
4	interact individually for a while	34.6	72.2
5	not getting involved in hand biting	11.5	66.7

Notes. FI=functional intervention.
FIP=functional intervention with physical arrangement.
None of the function-based interventions was implemented by the staff during baseline in any of the settings.

Discussion

The present study examined the effect of the physical arrangement on staff implementation of function-based interventions in a school and community support center setting. The results showed that in all three settings, staff implementation increased more during functional intervention with physical arrangement than during functional intervention without any physical change.

The results also showed a functional relationship between reduction in the student's hand biting and the extent of staff implementation. In each setting, the student's hand biting was more reduced and occurred less frequently during functional intervention with physical arrangement than during functional intervention.

These results indicate that the change in the physical arrangement promoted the student's desired behavior and staff implementation by changing the student's behavior. For example, in the school task setting, staff had to reduce encouragement in order to reduce the student's hand biting. Although the staff tried to do this during the functional intervention, they sometimes failed because the student was sometimes

not engaged in the task. Based on the student's performance during the functional intervention, re-arranging the location of materials and seats served to promote his engagement in the tasks, even without staff's constant encouragement during functional intervention with physical arrangement. Also, in free-time in the school and community support center settings, staff failed to play with him sometimes during functional intervention. But, by arranging his preferred materials so that they were not available without an interaction with staff, the student approached the staff, who then gave him the materials, which then served to induce appropriate play.

Also, detailed analysis showed that although there was no great difference across members of the staff, some of the procedures were affected by the physical arrangement. For example, reducing encouragement, interacting individually, and not getting involved in hand biting were difficult for staff sometimes during the functional intervention. But these procedures tended to be implemented more consistently during the functional intervention with physical arrangement. In the community support center setting with five staff alternating, variable implementation was especially observed during the implementation of functional intervention, but it became constant during functional intervention with physical arrangement.

The social procedures described above were considered to need more technique in order to respond to the student flexibly. On the other hand, the physical environment might make clear the interactive opportunities and promote staff implementation.

Thus, function-based interventions provide a logical link for changing the current relationship between a behavior problem and the environment. To do so, the present authors collaborated with staff in order to identify aspects of the physical environment related to both the student's and the staff members' behavior and to develop a functional hypothesis. We must pay more attention to the physical arrangement for effective interventions.

Recent research is drawing attention to procedural fidelity in order to ensure a functional relationship between the intervention and the reduction of behavior problems (Ingram et al., 2005; Kern et al., 2006). In the present study, staff implementation was continually measured, and the effect of the physical arrangement was clarified in order to promote staff implementation.

Physical arrangements are thought to be relatively easy to change across situations, so we should focus more on factors affecting staff implementation of function-based interventions. In everyday settings, staff cannot always readily implement interventions even when the interventions are perceived as effective and feasible (Hirasawa, Fujiwara, Yamamoto, Saito, & Oda, 2003). Conceptually, in order to promote staff implementation, an antecedent strategy (Bambara et al., 2001), instruction strategy (Ingram et al., 2005; Kern et al., 2006), and reinforcement strategy (Bambara et al., 2001) are needed. The present study demonstrates an antecedent strategy for promoting staff implementation based on arranging the physical environment so to promote a student's desired behavior. Hopefully, this will lead to the success of long-term outcomes in everyday settings.

Physical Arrangements and Staff Implementation

A limitation of the present study was that the student's desired behavior was not assessed continually. Anecdotally, the student's desired behavior increased in all settings. To confirm this, future research must examine the functional relationship between increasing the student's desired behavior and staff implementation with changes in the physical arrangement.

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