

Utilizing a Preferred Character as a Stimulus Prompt to Teach Table-Wiping Skills to a Student with Autism Spectrum Disorder

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This study examined the effectiveness of a preferred character as a stimulus prompt in teaching table-wiping skills to a student with intellectual disability and autism spectrum disorder who had pervasive support needs. A multiple-treatments design was utilized to determine if the projected character prompt strategy was the most effective, followed by the character puppet prompt and the marker prompt. Results indicated that the marker prompt strategy and the projected character strategy were equally effective in helping the student to acquire table-wiping skills and more effective than the character puppet prompt strategy. However, the projected character prompt strategy elicited the most positive expressions and the fewest refusal behaviors. In contrast, the marker prompt strategy induced the fewest positive expressions and the most refusal behaviors.

Keywords : stimulus prompt, cleaning, autism spectrum disorder, intellectual disability, projected character

I. Introduction

According to the national curriculum standards for special needs education schools in Japan, teachers must teach students with intellectual disability (ID) or students with autism spectrum disorder (ASD) cleaning skills (Ministry of Education, Culture, Sports, Science and Technology, 2017a). Although advancements in technology involving artificial intelligence and robots are progressing dramatically, manual labor in cleaning daily life environments is not likely to be completely replaced by technology for some time (Senoo et al., 2014). More importantly, having students use their own bodies to clean their daily life environments has been found to be valuable for nurturing work ethics and enjoying and appreciating things around them (Kamesaki, 2017; Ministry of Education, Culture, Sports, Science and Technology, 2017b).

Although these skills seem relatively simple, teachers are finding it challenging to teach cleaning skills to students with ID or ASD. First of all, viruses, dust, or germs are invisible, or at least hard to see, making it difficult

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for these students to understand what cleaning means and why it is necessary. This, in turn, may decrease their motivation to learn and use cleaning skills. Additionally, the invisibility of these particles makes it hard for students to identify where they need to clean. Furthermore, after they have wiped a table or vacuumed a floor, the same invisibility makes it hard for students to remember where they have cleaned and where they have not (Eckenrode et al., 2004).

To overcome or at least ameliorate these difficulties, stimulus prompts, which help visualizing otherwise invisible things, have been utilized to teach cleaning tasks. For example, strategies such as marking an erasable colorful circle on the table in wiping tasks or scattering pieces of papers on the floor in vacuuming tasks are commonly used to help students with ID or ASD identify where they need to clean as well as where they have cleaned and where they have not cleaned (Eckenrode et al., 2004). However, if the immediate consequence contingent on engaging in these tasks (e.g., disappearance of a colorful circle from the table, disappearance of a piece of paper from the floor) is not valuable to them (Takahashi & Ohtake, 2018), these stimulus prompt strategies (Alberto & Troutman, 2016) may not motivate students to engage in wiping or sweeping.

One strategy that can enhance the value of the consequence contingent on engaging in cleaning consists of utilizing a character preferred by the student in a way that is as functionally equivalent as possible to a colorful circle in wiping a table or sweeping up a piece of paper on a floor. In Japan, “Germ man” (Baikin man), “Mold girl” (Kabi-runrun), and “Dirty man” (Hora man) are popular characters featured on a TV animé program named “Red-bean-bun man” (Anpan-man). Many students with ID or ASD like these characters. Therefore, if these characters are displayed on a table or a floor and are blown away from the spot immediately after the students wiped or vacuumed it, the value of the consequence contingent on engaging in these cleaning tasks can be enhanced, motivating students to engage in the tasks. Additionally, if these characters are displayed on the spot that needs to be wiped or vacuumed, it will be easier for students to identify where they need to clean and where they don’t need to clean. In this sense, the displayed character functions as a stimulus prompt and is closely equivalent in function to a colorful circle in wiping a table or a piece of paper in sweeping a floor.

To date, no study has used a preferred character as a stimulus prompt to encourage and motivate students with ID or ASD to acquire cleaning skills. To fill this gap in the literature, the present study examined the effectiveness of utilizing a preferred character as a stimulus prompt to teach table-wiping skills to an elementary-aged student with ID and ASD. Specifically, the study used a multiple-treatments design to examine the effectiveness of the use of the preferred character strategy compared to other more conventional strategies.

II. Method

1. Participants

The subject was Takao (pseudonym), who had been diagnosed with ID and ASD by a qualified pediatrician, and was enrolled in the sixth grade at a school for students with intellectual disability in Japan. The *Tanaka-Binet Intelligence Test V* (Tanaka Education Institute, 2006) was administered when Takao was 11 years and 10 months old. However, his maladaptive behaviors during the test prevented the assessment from producing accurate scores. According to the *Social Maturity Scale III* (Ueno et al., 2016), which was administered at the same time, Takao's overall social maturity age was 1 year and 8 months, 1 year and 10 months for self-help, 2 years for locomotion, 1 year and 3 months for occupational skills, 2 years for communication, 1 year and 2 months for socialization, and 1 year and 1 month for self-direction.

In teaching Takao daily living skills, verbal, gestural, and physical prompts were typically used. However, his attention was easily distracted from the target activity, and when his teachers redirected him, he often exhibited noncompliant behaviors such as throwing and breaking objects, escaping from the activity, engaging in repetitive behaviors, and crying while saying "No." During free time, Takao frequently watched videos featuring his favorite characters via a DVD player or a tablet. When his teacher asked him what he watched, he responded by uttering the name of the character in the video.

Takao's teacher (the first author) had eight years of experience as a special education teacher in the elementary department of a school for students with special needs in Japan. He had served as Takao's teacher for five years when this study was initiated.

2. Characters Selected as Stimulus Prompts

According to his teacher, Takao frequently watched "Red-bean-bun man" when he was allowed to access YouTube during free time at school. In addition, Takao's mother noted that was also the DVD program he watched the most at home. Furthermore, according to the teacher, Takao frequently muttered the names of the characters featured in Red-bean-bun man, including Mold man, Germ man, and Dirty man. As mentioned, we hypothesized that these three characters could motivate him to wipe the surface of the table and, consequently, selected these characters as stimulus prompts.

3. Informed Consent

Before implementing the study, the first author obtained written informed consent from Takao's mother for her son to participate. Further, the study was approved by the research ethics committee of the university of the second author (approval number 17).

4. Target Behavior

The target behavior for Takao was to wipe his table, measuring 45 cm vertically

and 65 cm horizontally. The table was divided into six areas, consisting of upper-left (A1), upper-middle (A2), upper-right (A3), lower-left (A4), lower-middle (A5), and lower-right (A6). Each area was an approximately 22-cm square. Takao was required to wipe the table starting with A1, followed by A2, A3, A4, A5, and A6, in that order. "Wiping" was defined as moving a cloth from the present area to the next area (e.g., from A1 to A2) in such a way that the cloth kept touching the surface of the table. If Takao failed to initiate wiping within 2 sec after the teacher provided cues to start (see "Procedure" below), an incorrect response was coded by using paper-pencil recording sheets for the area. Similarly, if he stopped moving the cloth for 2 sec before reaching the center of the target area, an incorrect response was assigned for the area. Finally, if Takao moved the cloth to a nondesignated area (i.e., did not follow the correct order), an incorrect response was coded for the area.

5. Settings

Cleaning time, which was scheduled after lunch and break, was used to teach Takao the table-wiping skills. As described earlier, his attention was easily distracted by visual and auditory stimuli irrelevant to the target task. Therefore, the instruction was implemented in a physically structured place in Takao's homeroom, where any irrelevant items were eliminated and all sides were surrounded by curtains. The area was approximately a 2 m square.

6. Dependent Variables

(1) **Table-Wiping Skills** The number of areas that Takao wiped correctly was used as an indicator of his acquisition of wiping skills. Given that the surface of the table was divided into six squares, the score for each cleaning session ranged from 0 to 6.

7. Ancillary Variables

(1) **Positive Expressions** When Takao engaged in the following three behaviors - smiled (defined as a facial expression in which the corner of his mouth went up), clapped his hands, or tapped the table with his palm, even in a moment while wiping the surface of a designated area - "positive expression" was coded for that area. These three behaviors were selected as indicators of a positive expression by Takao's teacher based on his five-year relationship with the student. The number of areas where Takao showed a positive expression was used as an indicator of his positive attitude toward his task engagement. Therefore, the score in each session ranged from 0 to 6 for the table-wiping skills.

(2) **Task Refusal** When Takao said, "Finish" or "No," left the table, or handed the cloth to his teacher during a table-wiping activity, the behavior was coded as "task refusal." Given that the trial was terminated when task refusal occurred twice, the score in each session ranged from 0 to 2.

8. Data Collection

All sessions were video-recorded using the camera on a personal computer, which

was placed on the desk 1 m away from Takao's table. Although the computer was visible to Takao, he never noticed it and, therefore, didn't not interfere with the experiment.

9. Materials

In the baseline conditions, no materials, except a cloth, were used. In the marker conditions, an erasable black marker was used to draw a filled circle with a 2 cm diameter, intended to function as a stimulus prompt. In the character puppet conditions, Takao's favorite characters (i.e., Germ man, Mold girl, Dirty man) were downloaded from the characters' portal site onto a personal computer, printed on both sides of 5-cm square cards, and laminated. Each card was attached by tape to the top of a 20-cm long wooden stick.

In the projected character conditions, a mobile LED mini-projector (Onkyo Digital Solutions Company) was utilized to project Takao's preferred characters (i.e., Germ man, Mold girl, Dirty man). A 1.5-min video clip in which one of his preferred characters was moving was developed by using Corel Video Studio 2019, a video editing software. The video clip was saved in the secure digital card of the portable projector. The teacher manipulated the projector so as to start and stop projecting the character on the table. The same projector was used to project a 1-minute Red-bean-bun man video on the table as a reward for completing the table-wiping task, when appropriate.

10. Experimental Design

A multiple-treatments design was utilized to examine the most effective stimulus prompt strategy among the three conditions: the marker condition, the character puppet condition, and the projected character condition. Since the study was conducted during the COVID-19 pandemic, the teacher had difficulties to implement face-to-face instruction every day. Therefore, the baseline phase was not conducted. Instead, it was treated as one of the conditions during the multiple-treatments phase so that expected effective treatments can be introduced as soon as possible.

It was hypothesized that the character puppet prompt strategy and the projected character prompt strategy would be more effective than the marker prompt strategy because the former stimulus prompts consisted of Takao's preferred character. Additionally, the consequence contingent on engaging in wiping the table in the marker condition was that a black filled circle would disappear. In contrast, the consequence contingent on engaging in wiping the table in the character puppet condition and the projected character condition was that the characters representing dirtiness were blown away.

With regard to the relative effectiveness of the character puppet prompt strategy vs. the projected character prompt strategy, it was hypothesized that the latter was more effective than the former because the characters projected on the table were more similar to those on TV or video than the character puppets.

11. Procedure

The study consisted of the following three phases: multiple-treatments phase, best treatment phase, and partial withdrawal phase.

(1) Multiple-Treatments Phase One of the four conditions (i.e., baseline, marker, character puppet, and projected character conditions) was implemented daily during the cleaning time that took place after lunch and break. The order of the four conditions was as follows: baseline condition, followed by marker condition, character puppet condition, and projected character condition. In all conditions, the following procedures were utilized.

Step 1. The teacher brought Takao over to his table and encouraged him to sit down on the seat.

Step 2. The teacher handed a cloth to Takao's dominant hand (left hand) and placed Takao's hand in the center of the table.

Step 3. In the baseline condition, the teacher pointed to the center of the designated area (e.g., A1) and said, "Wipe out." In the marker condition, the teacher drew a black filled circle in the center of the area, followed by pointing to the area and saying, "Wipe out." In the character puppet condition, while moving a character puppet up and down in the center of the area, the teacher pointed to the area and said, "Wipe out." In the projected character condition, while projecting a 5 × 7 cm character in the center of the area, the teacher pointed to the area and said, "Wipe out." Finally, in the character puppet condition and the projected character conditions, the character featured in each session was rotated in order among the three characters (i.e., Germ man, Mold girl, Dirty man).

Step 4. The teacher waited for 2 sec to determine if Takao had started wiping. If Takao started wiping within 2 sec and continued to wipe the target area without stopping for more than 2 sec, the teacher provided verbal praise (e.g., "Great," "Blown away") in all conditions. Additionally, in the character puppet and the projected character conditions, the teacher moved the puppet or projected character away from the area immediately after the correct response occurred. If Takao did not start wiping within 2 sec or stopped wiping toward the target area for more than 2 sec, the teacher provided him hand-over-hand guidance to help him wipe the target area. If Takao showed a correct response with the physical prompt, the teacher provided him the consequences identical to those provided when the correct response occurred independently.

Step 5. Steps 3 and 4 were repeated for all six areas of the table within a session. If Takao exhibited task refusal behaviors (e.g., saying "No" or "Finish"; see "Ancillary Variables") twice, the teacher said, "OK, let's finish," and allowed Takao to leave the table.

Step 6. If Takao completed the wiping task for all six areas, the teacher expressed verbal appreciation (e.g., "Thank you for your hard work") and

projected a 1-minute video clip on the table, in which Red-bean-bun man punched the vehicle of Germ man and blew him away.

When Takao exhibited five or more correct responses over three consecutive sessions in any condition, the multiple-treatments phase was terminated.

(2) Best Treatment Phase The condition in which Takao reached the acquisition criterion in the shortest amount of time was implemented in all scheduled sessions until he showed five or more correct responses over three consecutive sessions.

(3) Partial Withdrawal Phase During the partial withdrawal phase, the verbal cue (i.e., saying, “Wipe out”) and the gestural cue (i.e., pointing to the central spot) were eliminated from the treatment package. Additionally, the 1-minute favorite character video that was used as a reward was also eliminated. Verbal praises that were provided contingent on a correct response in each area (e.g., “Great,” “Blown away”) and verbal appreciation that was expressed contingent on completion of the wiping task for all six areas were maintained throughout the phase.

12. Interrater Reliability Takao’s parents and his school’s administrators did not allow any other persons except the first and second authors to access the video data. Therefore, the second author, although he knew the purpose of the study, served as the second rater. The second author independently watched video clips of approximately 30% of the sessions across all three phases to record Takao’s table-wiping performance, positive expressions, and task refusal behaviors.

The interrater reliability scores of the three behaviors were computed by dividing the number of areas with agreements by the total number of areas with agreements and disagreements and multiplying by 100. As a result, the reliability scores of the three behaviors were 97%, 83%, and 100%, respectively.

13. Treatment Fidelity

The second author independently watched video clips of approximately 30% of the sessions across the three phases to determine if the teacher followed the procedures described in the “Procedure” section. Specifically, the second author checked if the teacher provided verbal and gestural cues, stimulus prompts (i.e., marker, character puppet, or projected character), verbal praises, verbal appreciations, and 1-minute video rewards as predetermined during the multiple-treatments phase and the best treatment phase. During the withdrawal phase, the second author checked if the teacher provided only stimulus prompts, verbal praises, and verbal appreciations as planned. Additionally, he checked across the three phases if the teacher terminated a session when Takao exhibited task refusal behaviors twice.

The fidelity score was computed by dividing the number of procedures implemented correctly by the total number of procedures implemented correctly and incorrectly and multiplying by 100. The fidelity score was 99%.

III. Results

1. Table-Wiping Tasks

Figure 1 shows Takao's wiping performance during the multiple-treatments phase, the best treatment phase, and the partial withdrawal phase. As illustrated, he reached the performance criterion (i.e., a score of 5 or 6 over three consecutive sessions) in the projected character condition in the shortest amount of time. Specifically, he reached a score of 5 from the fifth to the seventh session of the projected character condition. However, he obtained a score of 6 in the sixth and seventh sessions of the marker condition. Therefore, a session was added (i.e., an eighth session) to determine if Takao reached the criterion in the marker condition. He obtained a score of 5, resulting in him reaching the criterion. During the best treatment phase, therefore, the projected character condition and the marker condition were implemented alternately across sessions.

During the best treatment phase, Takao obtained a score of 5 or 6 for the first three consecutive sessions in the projected character and marker conditions. Therefore, both conditions continued to be implemented during the partial withdrawal phase.

As described, the verbal (i.e., saying, "Wipe out") and gestural (i.e., pointing to the central spot of the area) cues and the 1-minute video clip reward were eliminated during the partial withdrawal phase. In the projected character condition, Takao exhibited five or six correct instances of wiping in the first two sessions. However, in the third and fourth sessions, his performance deteriorated dramatically. Especially, in the fourth session (Session 44), he wiped only one area. On that particular day, Takao exhibited refusal behaviors all day because he was not feeling well and needed seven sessions to obtain scores of 5 or 6 across three consecutive sessions. In contrast, Takao needed four sessions to reach the criterion in the marker condition. From the fifth session, a stimulus fading procedure was implemented, where a black unfilled circle, instead of a black filled circle, was used as a stimulus prompt. Despite the stimulus fading, Takao continued to obtain scores of 5 or 6 over three consecutive sessions.

2. Positive Effects

Figure 2 shows the positive effects in each condition across three different phases. During the multiple-treatments phase, the projected character condition reached the highest score for positive effects ($M = 2.57$), followed by the character puppet condition ($M = 1.13$), the baseline condition ($M = 1.13$), and the marker condition ($M = 0.38$), in that order. During the best treatment phase, the projected character condition still produced higher scores of positive effects ($M = 1.33$) than the marker condition ($M = 0.33$). Similarly, during the partial

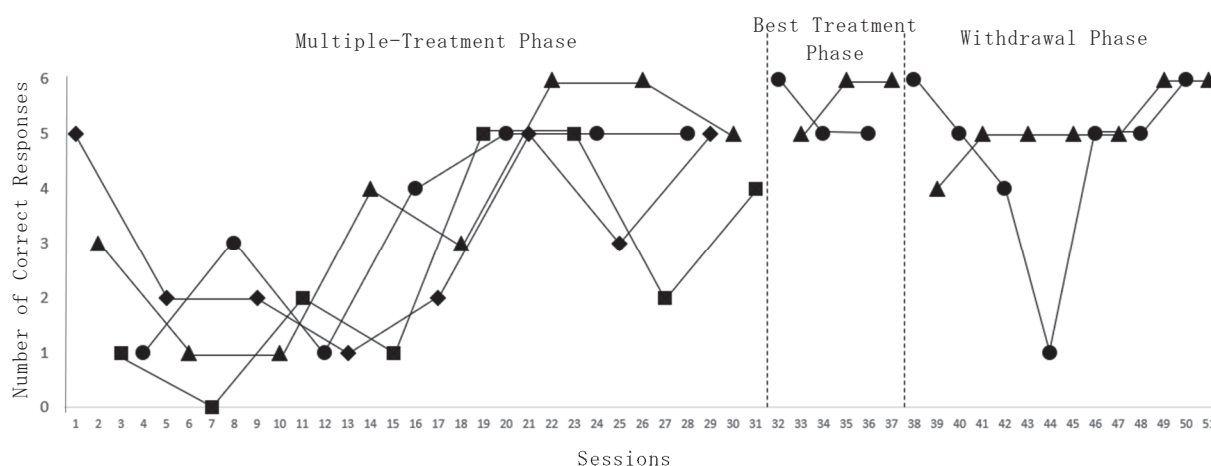


Figure 1 *Number of Areas That Takao Wiped Correctly* ◆ = baseline condition, ▲ = marker condition, ■ = character puppet condition, ● = projected character condition. A 19-day winter break was inserted between Sessions 23 and 24. In the withdrawal phase, response prompts (i.e., verbal direction and pointing) were eliminated. * = sessions where a black unfilled circle, instead of a black filled circle, was utilized as a stimulus prompt in the marker condition.

withdrawal phase, the projected character condition produced higher positive effects ($M = 1.43$) than the marker condition ($M = 1.14$).

3. Refusal Behaviors

Figure 3 shows the frequency of refusal behaviors during the wiping task. Although the ceiling effect must be taken into consideration (sessions were terminated if two refusal behaviors occurred), Takao showed the fewest refusal behaviors in the projected character condition ($M = 0.71$), followed by the character puppet condition ($M = 1.13$), the marker condition ($M = 1.25$), and the baseline ($M = 1.25$) during the multiple-treatments phase. During the best treatment phase and the partial withdrawal phase, no refusal behaviors occurred in either the marker condition or the projected character condition with the exceptions of Session 41 in the marker condition and Session 44 in the projected character condition. As mentioned earlier, when Session 44 was implemented, Takao's behavior was unstable all day as he was not feeling well.

IV. Discussion

This study investigated the effectiveness of using a preferred character as a stimulus prompt in teaching wiping table skills to a student with ID and ASD who had pervasive support needs. Specifically, the purpose of study was to determine if the projected character condition was the most effective, followed by the character puppet condition, the marker condition, and the baseline condition.

The results differed somewhat from our hypotheses. During the multiple-treatments phase, the marker condition and the projected character condition

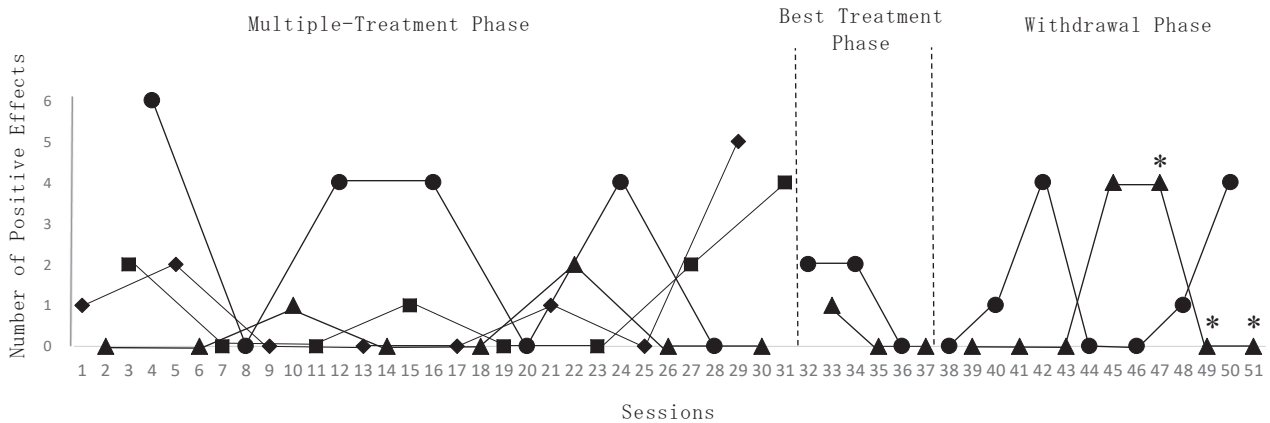


Figure 2 *Number of Areas Where Takao Showed Positive Effects* ◆ = baseline condition, ▲ = marker condition, ■ = character puppet condition, ● = projected character condition. A 19-day winter break was inserted between Sessions 23 and 24. In the withdrawal phase, response prompts (i.e., verbal direction and pointing) were eliminated. * = sessions where a black unfilled circle, instead of a black filled circle, was utilized as a stimulus prompt in the marker condition.

were equally effective in Takao acquiring table-wiping skills and more effective than the character puppet condition. In the character puppet condition, Takao grabbed the puppet immediately after it was presented as a stimulus prompt. Every time he exhibited the grabbing behavior, the teacher had to use full physical prompts to move Takao's hand away from the puppet. Frequent use of the full physical prompt made the session aversive to Takao because his request for grabbing the puppet were always rejected forcefully.

In the projected character condition, Takao attended to the character projected on the table and spontaneously moved the cloth to the projected character. In addition, he attended to the character when it was blown away from the table to a distant area. However, Takao occasionally attended to the character for too long, thus delaying his initiation of wiping behavior. Additionally, his positive facial expression sometimes disappeared immediately after the character was blown away to the faraway and invisible area. The teacher moved the character because he thought the movement of the character, which represented germs, molds, and dirt, might be enjoyable to Takao. However, the disappearance of the character may unexpectedly have reduced the value of the consequence contingent on engaging in wiping. If the teacher instead had moved the character to the next target area, Takao might have continued to engage in wiping the table to follow the character as it moved to the next target area.

As mentioned, the marker condition and the projected character condition did not differ in terms of their effect on Takao's table-wiping skills. However, the

two conditions differed significantly in the frequency of positive expressions and refusal behaviors. Specifically, positive expressions occurred the most and refusal behaviors occurred the fewest in the projected character condition during the multiple-treatments phase. In contrast, the marker condition induced the fewest positive expressions and the most refusal behaviors during the same phase.

In applied behavior analysis, two types of mechanisms increase the occurrence of a behavior: positive reinforcement and negative reinforcement (Alberto & Trautman, 2016). In positive reinforcement, a behavior is likely to occur because the occurrence of the behavior is followed by access to preferred stimuli or events. In negative reinforcement, on the other hand, a behavior is likely to occur because the occurrence of the behavior is followed by elimination of aversive stimuli or events. Considering the fact that the most positive expressions and the fewest refusal behaviors were observed in the projector condition during the multiple-treatments phase, the increases in Takao's spontaneous wiping may have occurred as a result of positive reinforcement. Further, according to anecdotal data, Takao said, "Can I see (the name of a character in Red-bean-bun man series)?" in almost all sessions when he came to the table to wipe. He smiled at and moved the cloth toward a projected character immediately after the character was projected on the table. This information corroborates the interpretation that the increases in Takao's spontaneous wiping in the projector condition may have occurred as a result of positive reinforcement.

On the other hand, considering the fact that the fewest positive expressions and the most refusal behaviors occurred in the marker condition during the multiple-treatments phase, the increases in spontaneous wiping may have occurred partly as a result of negative reinforcement. That is, according to the anecdotal data, Takao put his knees on the floor, saying, "done," after he had wiped one or two areas in the marker condition during the multiple-treatments phase. In addition, during the same phase, no smiles appeared on his face. Nevertheless, Takao's correct responses increased in the marker condition. This may be because he followed the teacher's direction as quickly as possible so that he could shorten the duration of the task engagement (i.e., aversive stimuli) as much as possible (Chadsey-Rusch et al., 1993).

As indicated, skills taught in the framework of positive reinforcement are not necessarily acquired more effectively and efficiently than those in the framework of negative reinforcement. However, if the two types of stimulus prompt strategies are equally effective, positive reinforcement should be selected because the recipient of the instruction would learn with enjoyment.

In this study, a character projected on the table was used as a stimulus prompt that visually emphasized the dirty area and enhanced the value of the consequence contingent on engaging in the table-wiping task. This strategy is innovative and can be applied to other tasks, including vacuuming floors, sweeping yards, and

wiping windows. In those tasks, the most preferred character, animal, or object would be projected and moved on the trajectory that the student is recommended to follow. For example, if the tarantula is the student's most preferred animal, the instructor videotapes a tarantula, uploads the video to the memory card of the projector, and projects the video on the surface that needs to be cleaned, along with verbal cues or prompts, like saying, "Let's catch up with the tarantula."

Several limitations of the current study should be noted. First, the multiple-treatments design may have caused carry-over effects across conditions even though several measures were employed to minimize the possibility of carry-over effects. For example, one condition was applied per day to provide at least a one-day interval between conditions. Additionally, each condition was developed in ways that helped Takao easily understand the difference of the conditions. However, the change pattern during the multiple-treatments phase (see Figure 1) suggests some synchronization in pattern of improvement.

Second, the study did not strictly follow the predetermined criterion related to when to move to the next phase (i.e., obtaining a score of 5 or 6 over three consecutive sessions). In fact, the projected character condition met the predetermined criterion the earliest among the four conditions during the multiple-treatments phase. However, we implemented one more marker condition to determine if Takao met the criterion in the same condition.

Finally, the study did not complete the withdrawal process due to the end of the school year. If time had allowed, the stimulus prompts (i.e., marker, projected character) should have been thinned until they were completely eliminated.

Nevertheless, despite these limitations, the study demonstrated the effectiveness of a projected character as a stimulus prompt to teach wiping table skills for a student with ID and ASD who had pervasive support needs. Future research is needed to determine if the projected character strategy is effective in improving a variety of cleaning skills (e.g., wiping windows, sweeping floor, vacuuming) for students with ID and ASD.

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