

## **CASE REPORT**

### **THE EMPIRICAL USE OF A MULTIPLE-VALUE REINFORCER IN A CLINICAL SETTING**

Robert M. Leve<sup>1</sup>  
*University of Hartford*

Susan O'Shea  
*HMEA*

#### **ABSTRACT:**

**Purpose:** This single subject case study investigated the effects of utilizing multiple-value reinforcement with Mark, a 16 year old male over the course of a 20 month longitudinal intervention.

**Method:** Behavior was recorded along four dimensions: aggression against persons, inappropriate verbalizations, noncompliance, and AWOL attempts. After a baseline phase Mark was given toys from a reinforcement box contingent on positive behavior. Next reinforcements were changed to pennies, then to nickels, and in the dual-value phase the nickels could be used as money or saved as tokens for a clothing article of high desirability.

**Results:** Although behavioral improvement occurred over all phases in all four target behaviors the greatest change occurred during the final dual-value phase in two target behaviors.

**Discussion:** Assigning more than one value to a reinforcer is beneficial in that it can increase desirability and balance the effects of short and long term reinforcement.

**KEYWORDS:** multiple-value reinforcement, client-selected reinforcement

The motivating power of a reinforcing stimulus is an important variable in promoting positive behavior changes (Strand, 2000). A number of studies have documented the advantages of including client preferences in the selection of reinforcers both as a means of facilitating behavior change and as an ethical responsibility toward clients (Landon, Davidson & Elliffe, 2003; Harding, Wacker, Berg, Barretto, & Rankin, 2002; Chambers & Rehfeldt 2003). No studies have investigated the assignment of multiple values to the same reinforcing stimulus; however such a procedure may increase the motivating power of a reinforcing stimulus in several ways. First, it provides the client with a wider range of preferences. Second, since client preferences change, often within short time periods, providing a reinforcer with a broad range of desirability should keep the motivating power of a reinforcer at a high level. Third, the values of the

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<sup>1</sup> Address correspondence to: Robert M. Leve, Ph.D., Graduate Institute of Professional Psychology, University of Hartford, 200 Bloomfield Avenue, West Hartford, CT 06117, E-mail: leve@hartford.edu, telephone: (860) 651-7648, FAX: (860) 651-7648.

reinforcing stimulus can be adjusted according to the preferences of the client and the economic resources of the agency. Lastly, the values of the reinforcer can vary on different dimensions which might be more appealing to the client. The present study utilizes an empirical approach within a clinical situation involving a 16-year-old male suffering from a degenerative neurological disorder. Treatment is provided within an AB parametric analysis design which uses nickels both for their monetary value and as tokens that can purchase menu items.

## METHOD

### *Participant and Setting*

Mark is a 16-year-old male diagnosed with mild cognitive impairment and conduct disorder, adolescent onset type. He grew up in an “inner city, street wise” environment, was impressionable and easily influenced by peers. As a result of parental incompetence and neglect, legal custody was taken by the state and he was placed in the home of his maternal grandmother. At age fourteen he was diagnosed with a terminal degenerative neurological disorder which causes unsteady movements, speech difficulties, problems with chewing food, and lack of balance when walking. As a result of minor larcenies, school noncompliance, running away from home, and infrequent but intense violent outbursts, including an assault on a teacher, he was hospitalized on a locked adolescent unit at a state psychiatric facility for fourteen months. Through this period he was at times aggressive and violent on the unit and there were numerous attempts to escape from the facility. Because of his terminal illness and the inappropriate restrictive nature of the state facility he was removed by judicial mandate and placed in a specialized foster home with 24-hour staffing. At that time he was enrolled in special education classes in the local school district and assigned a dedicated paraprofessional to help with academic tasks and control his behavioral outbursts.

### *Response Definitions and Interobserver Agreement*

A functional assessment of Mark’s behavior (O’Neill, Horner, Albin, Storey, & Sprague, 1990) both in his foster home and at school identified the following target behaviors of concern:

*Aggression against Persons:* Hitting with a closed fist or open hand, kicking, spitting, and choking (wrapping full arm around the neck of another person and dropping down to add weight pressure).

*Inappropriate Verbalization:* Swearing (excluding use of words such as damn and s-t in a casual manner as part of a sentence during general conversation); Yelling directed at a person while entering into their personal space.

*Noncompliance:* Failure to complete critical responsibilities (i.e. take meds); Refusal to comply with direction (e.g., “we need to leave now”). This did not include activities which were not essential and were safely within Mark’s rights to refuse.

*AWOL:* Moving away from and out to the sight of supervision with the intent of leaving an area ultimately going beyond the boundaries of the property. This allows for freedom of movement within the home, school, etc., to obtain privacy. At times Mark attempted to run away from his foster home and these behaviors were especially dangerous as they placed Mark at risk of physical injury due to his medical condition. This target behavior was of special concern as it was a low frequency-high intensity behavior and potentially difficult to eliminate.

Data collection was carried out by the support staff after training by both authors. In addition, data were reviewed weekly by the coordinator of clinical services and any indications of observer or procedural drift were corrected. All data were taken during waking hours via indirect staff observation initially using a FI-15 and then a FI-30 partial interval time sample.

Inter-observer reliability estimates were collected and calculated for each target behavior using an interval by interval agreement formula. Reliability for AWOL, Inappropriate Verbalizations, and Aggression against persons was 95 percent; reliability for Noncompliance was 90 percent. Because the reliability estimate for AWOL incidents was based on highly infrequent incidents, this estimate was also confirmed by direct report and achieved a 100 percent inter-observer reliability.

### ***Procedures:***

*Baseline Phase.* Baseline data was taken every day for a four week period on all four behaviors.

*Token-Reinforcer Box Phase.* The first phase of the intervention occupied 17 weeks. In this phase an FI-15 minute schedule of reinforcement was initiated upon Mark's arrival at his foster home. Reinforcement consisted of Popsicle sticks as tokens which were exchanged for reinforcement box items. The box contained small items of value such as trinkets, pocket computer games, and pennies. Mark was reminded daily about the target behaviors and that he would be earning Popsicle sticks as long as he did not exhibit any of the target behaviors. Popsicle sticks were immediately exchanged for reinforcement box items.

*Token-Pennies Phase.* Within two weeks Mark only traded the Popsicle sticks for pennies which he kept in his pocket and occasionally spent on outings to local stores and malls. At that time the Popsicle sticks were eliminated and he received pennies directly. When questioned, Mark said that he chose the pennies because he wanted to have his own money and he liked the feel of coins in his pocket. When asked if he would like to earn more money as pennies could not buy much, Mark said, no he was happy with the pennies. However after three weeks of additional trips to the mall he decided that he would like to earn nickels.

*Nickels Phase.* This change in the reinforcing stimulus initiated the third intervention phase of the study. With Mark's agreement his schedule was increased to an FI-30 minute and he only earned nickels which were spent on his various outings. This phase continued for 7 weeks. Mark's AWOL incidents were of special concern because

they involved personal danger. On one of his AWOL outings he was missing for hours and finally found in a dangerous inner-city area. Another time he was struck by an automobile trying to board a bus and needed to be checked by emergency paramedics. Fortunately, he was not injured and was released. In an effort to completely eliminate this behavior the reinforcement system was changed in an attempt to increase the motivating power of the reinforcements.

*Dual-Value Reinforcer Phase.* This fourth intervention phase of the study was initiated by telling Mark he could continue to use the nickels for their monetary value or he could use them as tokens to earn special items he wanted. This change meant that the reinforcing stimulus now had multiple values. The nickels could be a short term reinforcer in that they could be spent within a day or two at their monetary value, but they could also be a longer term reinforcer as tokens which had to be saved for approximately a week to obtain a desired object. Mark chose to earn a special pair of desirable baggy pants he had seen at the mall. In order not to strain Mark's motivation the number of tokens needed to earn the pants was adjusted so that based on his previous rate of behaviors he could earn the pants within a week. Based on the cost of the pants the number of nickels needed inflated their value as tokens to approximately twenty seven cents each. Nickels were saved in a special jar kept on the kitchen counter where Mark could see how many he had earned. At any time Mark could take nickels out of the jar to be spent or left to be saved to earn the pants.

## Results

Figures 1 through 4 illustrate changes in Mark's behavior on each of the four target behaviors. Since the study was carried out over a 21-month period the graphs of the target behavior are a longitudinal indication of Mark's behavior changes. Each graph shows the weekly data in each of the intervention phases of the study as follows: In the Token-Reinforcer Box Phase, Mark earned Popsicle Stick as tokens which were traded for reinforcement box items. In the Tokens-Pennies Phase, Mark earned Tokens which he traded for pennies. In the Nickels Phase, Mark earned nickels to be spent according to his wishes. In the Dual-Value Reinforcer Phase, Mark earned nickels that could be used as money or tokens to earn specially identified items. Each data point indicates the daily summed behavioral incidents for that week.

Figure 1 shows the decrease in Noncompliant behaviors over the four intervention phases. The mean number of weekly incidents for Baseline is  $M=16.3$ , for Token-Reinforcer Box Phase is  $M=11.2$ , for the Pennies Phase  $M=15.5$ , for the Nickels Phase  $M=13.0$  and for the Dual-Value Phase  $M=6.9$ . The range of daily incidents was quite variable from 0 to 50. Figure 2 shows the data for Inappropriate Verbalizations. Those means were Baseline  $M=18.3$ , Token-Reinforcement Box Phase  $M=13.8$ , Pennies Phase  $M=13.0$ , Nickels Phase  $M=14.3$ , and Dual-Value Phase  $M=5.3$ . The range over all phases was 0 to 48. Figure 3 shows the data for Aggression against Persons. Those means were Baseline  $M=0.5$ , Token-Reinforcement Box Phase,  $M=1.5$ , Pennies Phase,  $M=0.9$ , Nickels Phase,  $M=0.0$  and Dual-Value Phase  $M=0.1$ . The range over all phases was 0 to

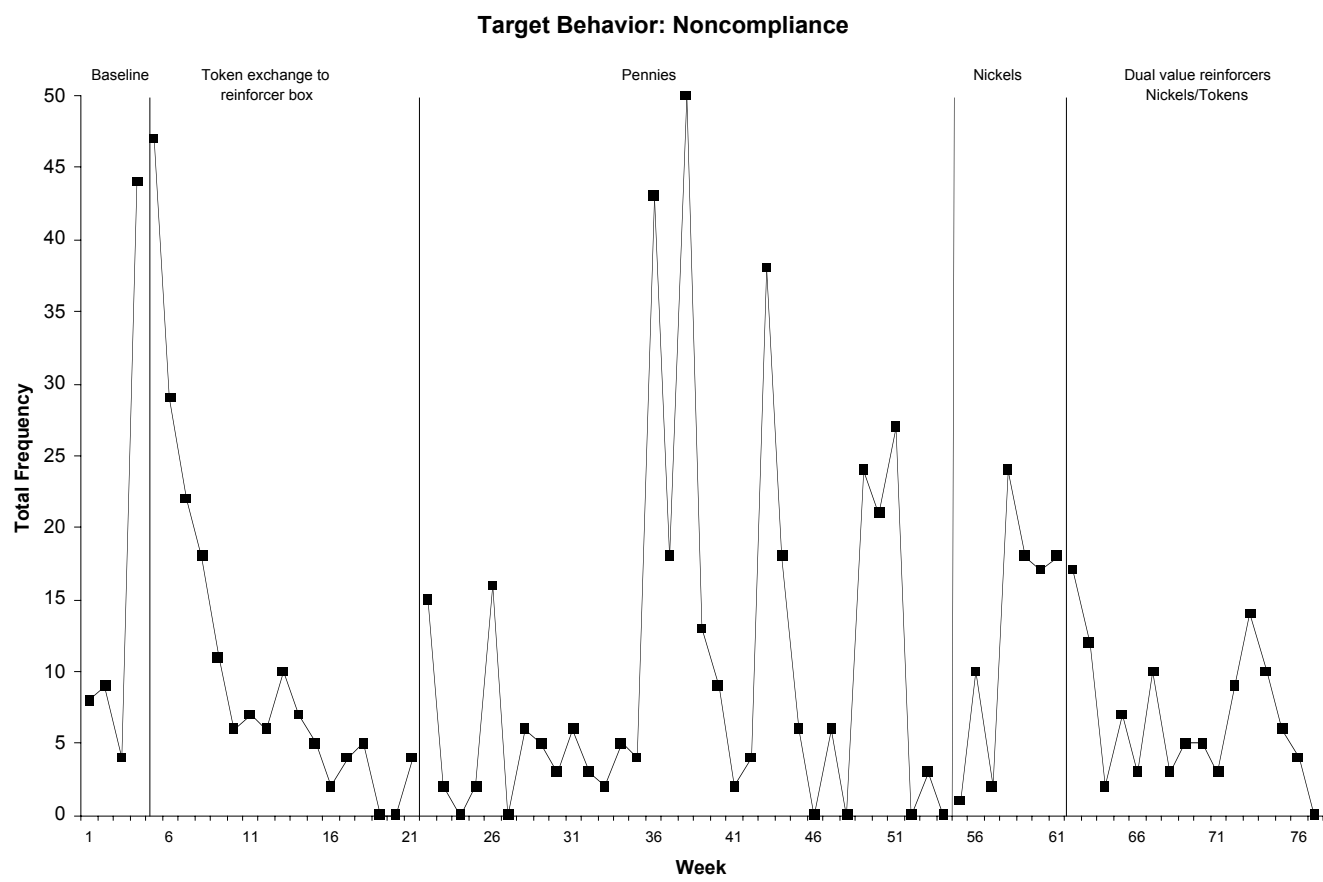


Figure 1. Weekly incidence of noncompliant behaviors.

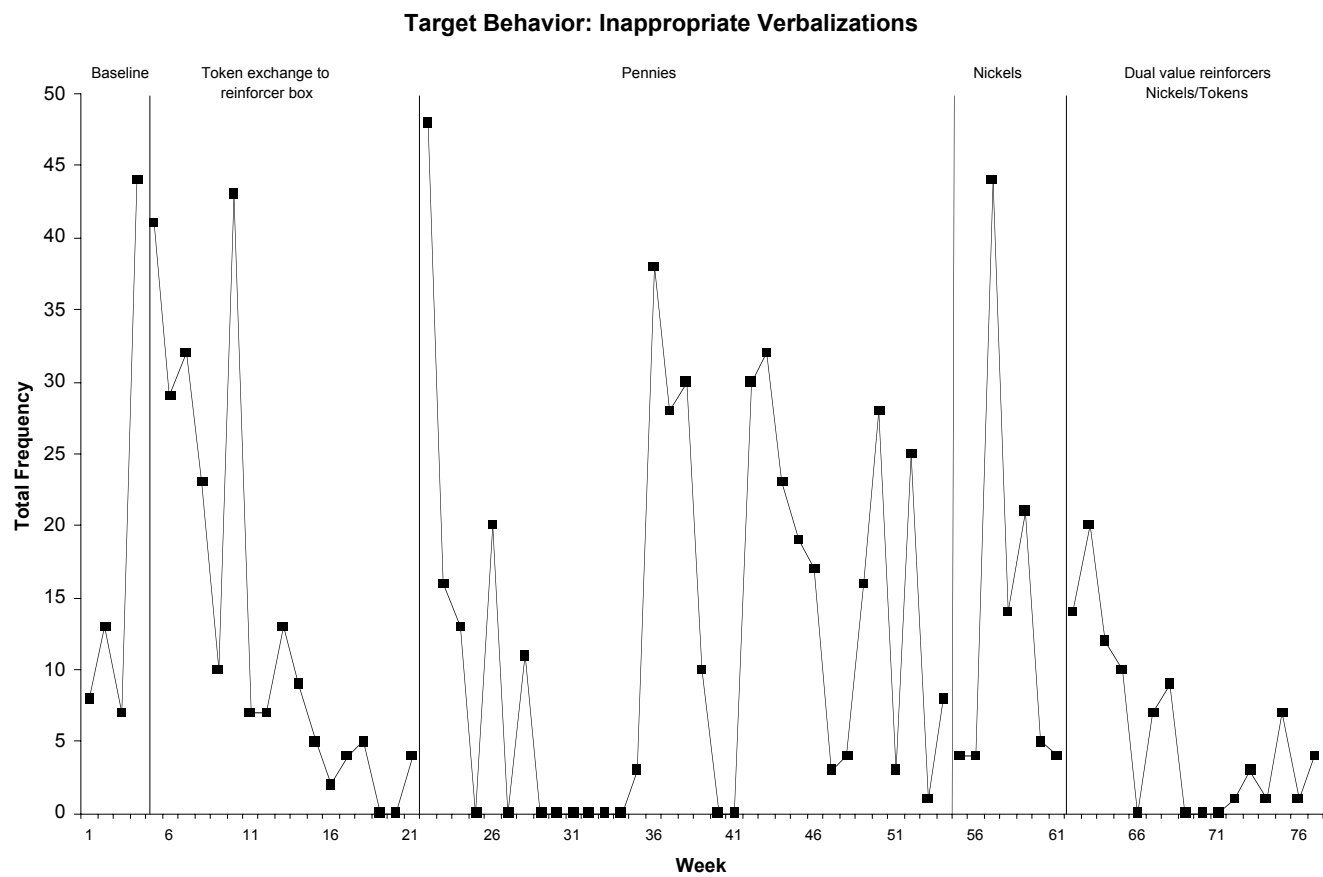


Figure 2. Weekly incidence of inappropriate verbalizations.

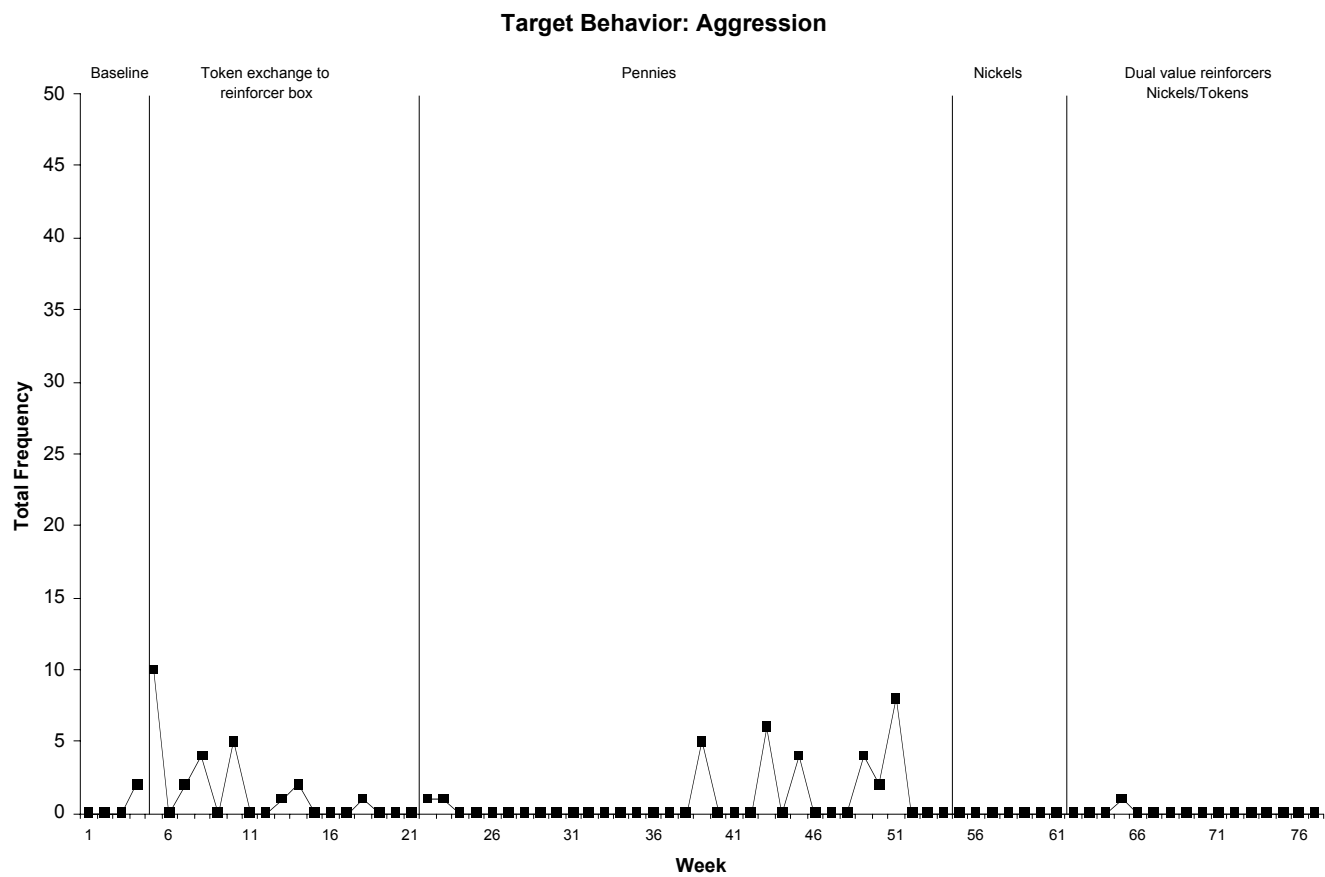


Figure 3. Weekly incidence of aggression against persons.

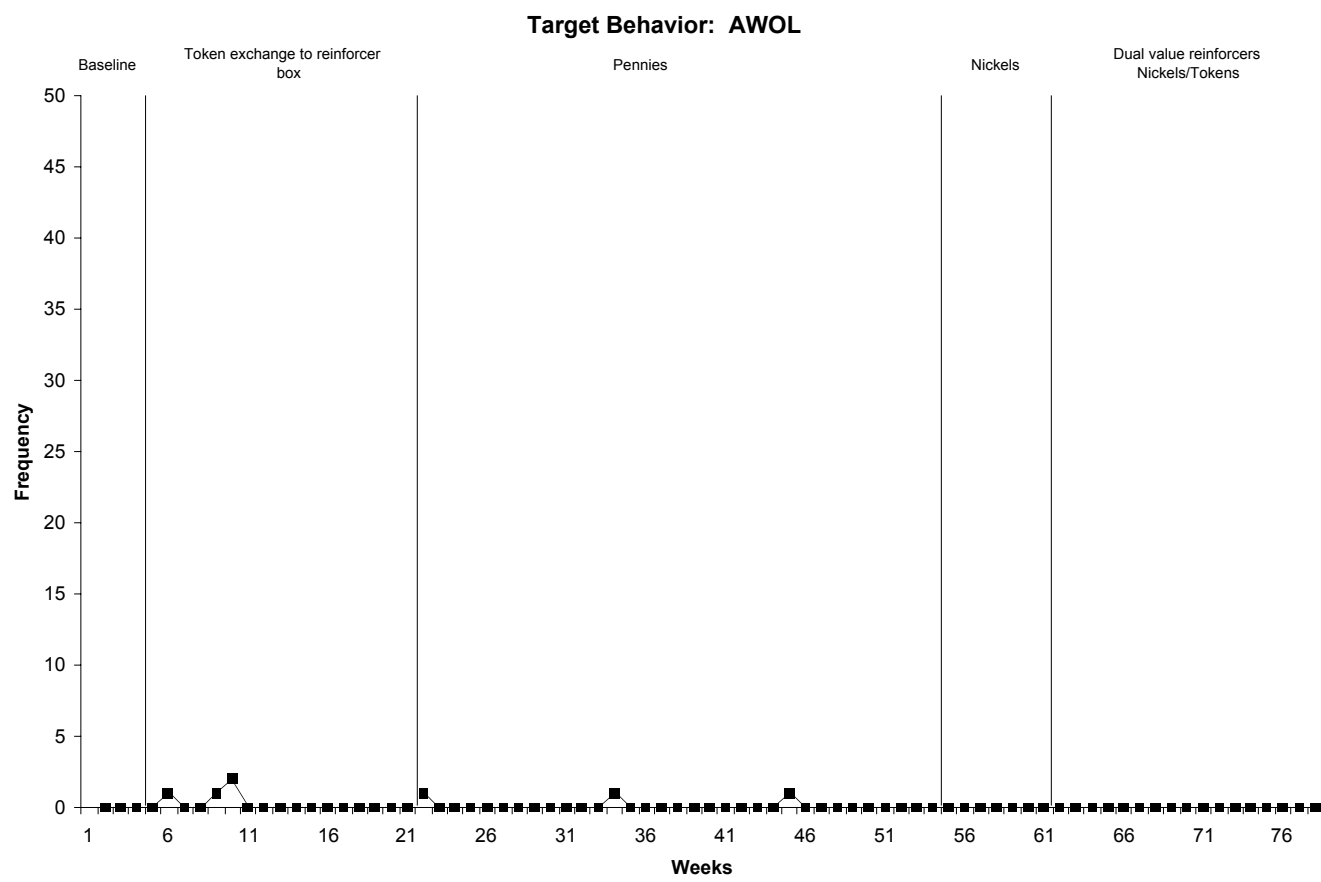


Figure 4. Weekly incidence AWOL events.



10. Table 1 shows the means for all phases for Noncompliance, Inappropriate Verbalizations, and Aggression against Persons. Due to the infrequency of AWOL incidents, phase means were not calculated.

Overall results show a decline across the phases of two target behaviors, Inappropriate Verbalizations and Noncompliant Behaviors, and indicating that the Dual-Value Reinforcer Phase resulted in less negative behaviors than the other phases. Aggression against Persons showed a decrease compared to the first two phases, but there was almost no difference in this target behavior between the Nickels Phase and the Dual-Value Reinforcer Phase indicating that the use of multiple reinforcement was no more effective than the use of a single reinforcer. A similar pattern emerged in respect to AWOL behavior indicating no difference between the Nickels phase and the Dual-Value Reinforcer phase.

### DISCUSSION

In this study Mark was able to self-select both reinforcing stimuli, the nickels and the pants. A number of studies (Piazza, Fischer, Hogopian, Bowman, & Toole, 1996; Graff, Libby, & Green, 1998) have confirmed the efficacy of client-selected, high preference reinforcers with a wide range of clients. Tustin (1994) has shown that clients have a preference for different reinforcers rather than a single reinforcer and that was done in this study by allowing Mark to select any desired object he chose to earn via tokens or purchase with nickels. This type of multiple-value reinforcer procedure not only provides greater efficiency for the behavior analyst, but it allows increased flexibility by providing the client with more options in obtaining a self selected, high preference reinforcement.

TABLE I. MEANS OF TARGET BEHAVIORS

Target Behaviors	Baseline	Token Reinforcer Box	Tokens- Pennies	Nickels	Dual-Value Reinforcer
Noncompliant Behaviors	16.3	11.2	15.5	13.0	6.9
Inappropriate Verbalizations	18.3	13.8	13.0	14.3	5.3
Aggression Against Persons	0.5	1.5	0.9	0.0	0.1

The results obtained during the 21 months of the study show an interesting pattern in terms of the differences between the four target behaviors. Two behaviors, Inappropriate Verbalizations and Noncompliant Behaviors indicate that using multiple reinforcements facilitated positive changes as compared to all phases including the single reinforcement Nickels phase. However, the other target behaviors, AWOL and Aggression against Persons did not show any important differences between the administration of a single reinforcement during the Nickels phase and the Dual-Value Reinforcer phase. Since the study was carried out over a 21-month period and the Dual-Value Reinforcer Phase occupied a 15 week period it is unlikely that the time involved was not extensive enough for a difference to emerge. A more likely explanation is that since no instances of Aggression and AWOL behaviors were observed during the Nickels Phase a further decline was not possible (a floor effect). Thus, if the multiple value reinforcement procedure was effective as with the other two behaviors, it could not be observed. The data does indicate that the multiple value reinforcement procedure did at least maintain the elimination of these very problematic behaviors. Alternatively, the particular multiple reinforcers used may not have been motivating enough to overcome the distractions and emotional intensity of aggression toward staff members or the attraction of escaping from a staff member.

Sadly, Mark's degenerative neurological disorder may also have made him less able to engage in aggressive and escape activities as the study progressed. These behaviors require physical exertion that may have become more difficult over the 21 month span of the study whereas being noncompliant and verbally inappropriate do not necessitate the same amount of physical activity. Certainly, additional studies with other clients and in differing situations will be needed before this question can be answered. Since AWOL and Aggressive behaviors tend to be low frequency, high intensity behaviors, and are difficult to bring under stimulus control (Ishii, 2002) the question of whether these can be better controlled by Dual-Value Reinforcement procedures is important.

An advantage to the use of a dual-value reinforcing stimulus is that it is simple and cost effective. By assigning different values to the same reinforcing stimulus (the nickels) the client is provided with two or more reinforcements, and the cost of reinforcing stimulus is more easily controlled since there is only one object used. If dual-value reinforcements are selected by the client, motivation for increasing or decreasing behaviors is more likely to be increased and maintained. In addition, habituation to a reinforcing stimulus is less likely to occur when that reinforcing stimulus represents more than one desired option. Another benefit is that if desirability of a particular reinforcer waxes or wanes, having more than one reinforcer option is more likely to provide a client with something they desire.

One of the most interesting and important aspects of the study relates to the meaning of the reinforcing stimulus as perceived by the client. Although Mark was able to use the nickels as money or as tokens for the special pants, he never saved the needed nickels to obtain the pants throughout the four plus months of the Dual-Value Money/Token phase. Though he was often prompted by his foster parent and staff about saving his nickels, he usually saved them for a few days and then decided to spend them as nickels on one of

his outings. Perhaps the perception of the reinforcing stimulus carries its own importance irrespective of whether or not the reinforcement is actually delivered and obtained.

Another unique quality of this particular intervention is that it incorporated self-determined non-contingent reinforcement. So long as there were nickels in the jar Mark was able to remove them at any time he chose non contingent on his behavior at that moment. This allowed Mark the freedom to utilize the nickels as he saw fit and he often took them in times when he was upset or seemed to feel needy. Having the liberty to utilize self-determined non-contingent reinforcements may have also contributed to the improvement in his problematic behaviors.

Of course, the value of a reinforcing stimulus depends on its attractiveness, the delay the client must endure, and the probability of attaining the reinforcement, and all of these factors determine the client's perception of the reinforcement (Harding & Wacker, 1999; Roll, Reilly, & Johanson, 2000). By using reinforcements with multiple values a client has the option of electing a short or long term reinforcer and this is likely to enhance behavior change (Hoch, McComas, Johnson, Faranda, & Guenther, 2002; Logan, Kinsinger, Shelton, & Brown, 1971; Waldron-Soler, Martella, Marchand-Martella, & Ebey, 2000). Such multiple-value reinforcers are common in natural economic environments. The most common example is money which can be used for short term or long term reinforcements depending on whether it is quickly spent or saved for a long term goal.

This study within a clinical setting must be viewed as an AB parametric analysis design as opposed to an experimental reversal design. However, the results indicate that utilizing a multiple-value reinforcer may be useful in modifying certain negative behaviors, and the authors hope further research will be initiated by this study.

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