

## An educational programs to providing an ability to pay for fares on trains and streetcars for a child with middle-functioning autism

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### Introduction

Autistic disorder is a neurological and developmental disorder that usually appears during the first three years of life. A child with autism appears to live in his/her own world, showing little interest in others, and a lack of social awareness. The focus of an autistic child is a consistent routine and includes an interest in repeating odd and peculiar behaviors. (APA,2000) Autistic children often have problems in communication, avoid eye contact, and show limited attachment to others.

Keeping these peculiarities of autistic child in mind, it is clear that the objectives of daily living skills instruction for a child with autism will change as the child's skill level changes, as the child grows older, and as the child is required to perform the skill in different settings. An elementary school student, for example, may need to learn skills such as dressing independently with clothes selected by his or her parents, recognizing coins and currency, eating in a school cafeteria, riding on a school bus, and making his or her bed. During the middle school years, it may be appropriate for the same student to learn to select clothing to wear (based on both the weather and the styles worn by other children), count money and make change, eat in restaurants, and clean his or her room. During the high school years, instruction for this student may focus on purchasing and maintaining clothing, budgeting money, preparing meals and cleaning

the kitchen, using public transportation or taxis, and helping out with household maintenance. (Carothers& Taylor,2004)

Kazuo (a pseudonym), at his age of 17 year old, was diagnosed for middle functioning autism with hyperactive behaviors. (Utsunomiya,et al., 2007)

The streetcar in Matsuyama has a fixed fare of 150 yen, regardless of distance traveled. (Iyo Railway Co.,Ltd Hp) On the other hand the suburban railway has a basic charge of 200 yen with an additional 50 yen payable for every two stops traveled, with a maximum fare of 500 yen. (Iyo Railway Co.,Ltd Hp)

In the near future Kazuo will have to use the streetcar and train to travel to his day-care center.

The goal of this role play simulation and practice is to have Kazuo acquire the ability to pay for daily necessities and transportation fares totaling less than 666 yen, by using Japanese six coins of different denomination.

### Methods

#### (1) Material preparation and procedure

In this report, we used six denominations of Japanese coins in the training we carried out for the purpose of improving Kazuo's ability to pay for fares on trains and streetcars.

In each training session Kazuo used six coins totaling

666 yen. They comprised a five hundred yen coin (500 yen), a one hundred yen coin (100 yen), a fifty yen coin (50 yen), a ten yen coin (10 yen), a five yen coin (5 yen) and a one yen coin (1 yen).

We intentionally used a rusty bronze 5 yen coin in order to clearly distinguish between the 50 yen coin and the 5 yen coin.

In the role-play Kazuo was able to use 6 coins to pay an exact amount without generating any change, e.g. 151 yen can be paid with one 100 yen coin, a 50 yen coin and a 1 yen coin. Other values for which Kazuo can pay with the exact money are 160 yen, 165 yen, 500 yen, 505 yen, 555 yen, 561 yen, 600 yen and 666 yen.

We limited the role-play practice so as to avoid creating any situation where the payment required totaled more than 666 yen. That is to say, we always ensured that Kazuo had sufficient funds for each purchase and that he was always in a position where he was receiving change.

(2)Role- play simulation

We had Kazuo understand the value of each coin based on its position on a color-coded card (“value-card”), enabling him to use color as an additional visual hint in his selection of coin denomination. The value card is a piece of paper 7 cm by 9cm, comprising three 3cm colored strips (green, yellow and blue). When using the value-card to pay for an item worth 128 yen, there are two possible ways of paying.

One way is to use a single 500 yen coin. The other way is to make up the sum using a 100 yen coin and a 50 yen coin.

We taught Kazuo three rules which, when applied to the value-card, gave him visual hints and thus assisted him in determining the value of each denomination of coin.

- 1 .The 500 yen coin and the 100 yen coin must be on the green strip.
- 2 .The 50 yen coin and the 10 yen coin must be on the yellow strip.
- 3 .The 5 yen coin and the 1 yen coin must be on the blue sheet.

The leftmost strip of the value-card (green) became, in effect, the hundreds column, and was the location specified for the 500 and 100 yen coins. All the items involved in the training had a value greater than 100 yen but less than 666 yen. When Kazuo had to pay for something we had him look at the price with reference to the value-card. We encouraged Kazuo to select the 500 yen coin (representing the hundreds column) when making purchases.

For example where an item costs 128 yen Kazuo should pay with the 500 yen coin. If, for an item costing between 100 and 199 yen, Kazuo happened to choose the 100 yen coin we then had him choose the highest value coin in the tens column.

For a 128 yen item, following the selection of a 100 yen coin the next coin he should choose is the 50 yen coin.

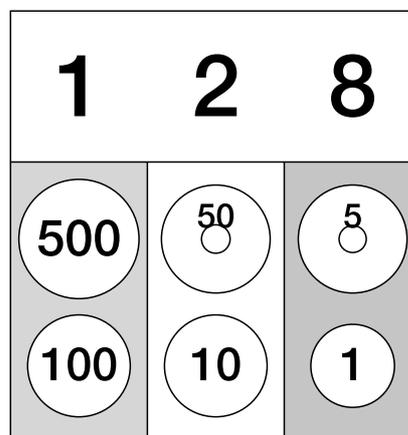


Fig.1 The following example demonstrates paying for an item worth 128 yen

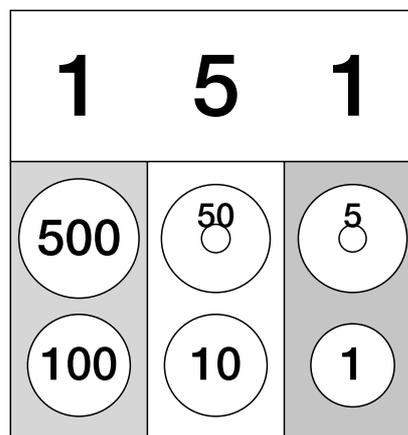


Fig.2 The following example demonstrates paying for an item worth 151 yen

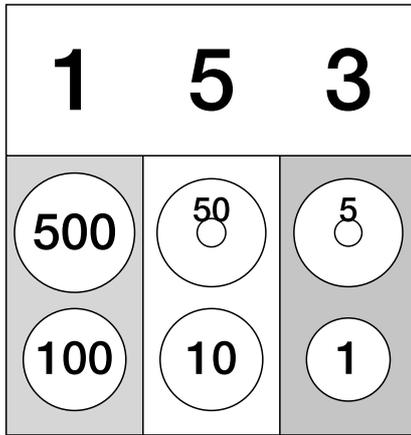


Fig.3 The following example demonstrates paying for an item worth 153 yen

For example, where an item costs 153 yen, Kazuo should pay with the 500 yen coin. If Kazuo happened to choose the 100 yen coin we then had him choose the highest value coin in the tens column. For an item worth 153 yen, following the selection of a 100 yen coin the next coin Kazuo should choose is the 50 yen coin. Lastly, Kazuo must account for the final 3 yen.

Although there is a 5 yen coin on the blue strip which represents the ones column, we have Kazuo choose a 10 yen coin from the yellow strip (the tens column). This is done so that Kazuo is not forced to carry out the calculation of '5 minus 3'.

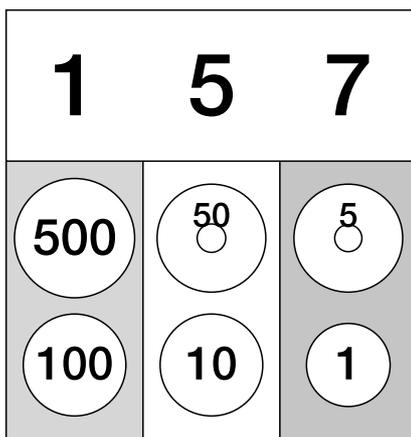


Fig.4 The following example demonstrates paying for an item worth 157 yen

Applying the same methods used for a 153 yen item to a 157 yen item is easy. Kazuo need choose only a single 500

yen coin or a 100 yen coin plus the combination of a 50 yen and 10 yen coin. When the price of an item ends in zero, i.e. the ones column is zero (corresponding to the blue strip of the value-card), Kazuo has no problem making payment. Whenever there is a value in the ones column other than zero, Kazuo only has to choose the 10 yen coin from the tens column (yellow).

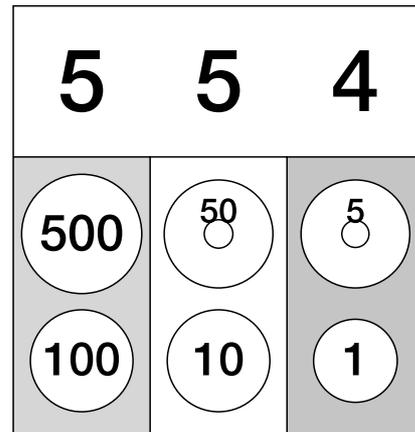


Fig.5 The following example demonstrates paying for an item worth 554 yen

In the same way, when using the value-card to pay for an item worth 554 yen, Kazuo should pay with a combination of a 500 yen coin and a 100 yen coin. If he chooses only a 500 yen coin, we indicate that he should select an additional 100 yen coin. Nevertheless, Kazuo often chose a 50 yen coin instead. Since the value in the ones column is 4, it falls into the category of cases without zero in the ones column, so we have Kazuo to choose a 10 yen coin as his next selection.

### Results

Practicing getting around using trains and streetcars.

We showed Kazuo how to make his own way to the daycare center by means of train and streetcar. We made sure Kazuo always carried a total of 666 yen, in coins of six denominations: a 500 yen coin, a 100 yen coin, a 50 yen coin, a 10 yen coin, a 5 yen coin and a 1 yen coin.

The fare from the train station near Kazuo's house to the station closest to the streetcar stop is 200 yen. To

purchase a train ticket Kazuo put the 500 yen coin into the vending machine. He received a 200 yen ticket and three 100 yen coins as change.

Having paid for the train ticket Kazuo now possessed 7 coins totaling 466 yen: four 100 yen coins, one 50 yen coin, one 10 yen coin, one 5 yen coin and a 1 yen coin. Kazuo next had to take the streetcar to the daycare centre, first taking the Johoku line and then changing to the Dogo line.

The streetcar fare is fixed at 150 yen. On the first streetcar Kazuo was able to pay with the exact change, using a 100 yen coin and a 50 yen coin. After paying for the first streetcar Kazuo possessed 5 coins totaling 316 yen: three 100 yen coins, one 10 yen coin and a 1 yen coin.

Kazuo also has to pay 150 yen for the second streetcar, but he no longer has a 50 yen coin. Instead he paid with two 100 yen coins and completes his trip to the daycare centre.

## Discussion

Specialized behavioral and educational programs are designed to treat autism. Behavioral therapy (Runco & Schreibman, 1983) is used to teach social skills, motor skills and cognitive (thinking) skills. Behavior modification is also useful in reducing or eliminating maladaptive behaviors. Individualized treatment planning for behavioral therapy is important as autistic children vary greatly in their behavioral needs. Intensive behavior therapy during early childhood and home-based approaches training and involving parents are considered to produce the best results.

One educational goal of mathematics is the acquisition of the ability of deduction, through which people can create abstract ideas from concrete objects. (Ministry of Education, Culture, Sports, Science and Technology, 1999) Unfortunately, Kazuo did not grasp the coin equivalent concept.

According to some reports, (Trace, Cuvo & Criswell, 1977; Frank, et al., 1980; McDonagh, McIlvane & Stoddard, 1984) children whose IQ is below 70 have difficulty in

comprehending the concept of coin equivalence, for example, that five 1 yen coins correspond to a 5 yen coin and five 10 yen coins is the same as a 50 yen coin.

Our goal in improving Kazuo's mathematical ability is to have him correctly read off the numerical figure on the surface of each coin and to comprehend the correlating value of the six denominations of Japanese coins.

Our modified coin combination method (Noro & Kobayashi, 1996) can potentially solve the problem of the coin equivalent concept between the tens column and the ones column. That is to say, Kazuo does not need to compare the value of the coins in the ones column with the purchase price of the item.

To avoid the mental calculation involved in the coin equivalent concept, where a purchase price has a value of anything except zero in the ones column, a 10 yen coin should be used to cover the payment. The 666 yen value-card training stands him in good stead in the daily tasks of getting around and making purchases.

In Tokyo, some ticket vending machines do not dispense change in the largest denomination coins possible, but include smaller denomination coins. For example, when purchasing a 200 yen ticket with a 500 yen coin some vending machines do not give the change in the form of three 100 yen coins but as two 100 yen coins, one 50 yen coin and five 10 yen coins.

To ensure that Kazuo gets change and does not have to perform mental arithmetic, our modified coin combination method encourages him to look first to the hundreds column and then to the tens column when making payments.

If Kazuo finds himself in a situation where he has no 100 yen coins, but has five 50 yen coins, six 10 yen coins and a 1 yen coin (totaling 361 yen), because he does not yet understand coin equivalence he is unable to pay the 150 yen streetcar fare, despite having enough money. In a hypothetical situation where Kazuo has two 100 yen coins, one 50 yen coin and two 10 yen coins totaling 270 yen, and the train fare is 170 yen, he has been trained to pay not with one 100 yen, one 50 yen and two 10 yen coins but

with two 100 yen coins. In cases where the ticket vending machine gives change in the form of 50 yen and 10 yen coins Kazuo is faced with the task of counting the coins he has, working out their value, and comparing it to the price of the ticket.

In our modified coin combination method we did not teach Kazuo the coin equivalence concept, for example, that two 50 yen coins correspond to one 100 yen coin.

As a result of the way in which some ticket vending machines dispense change, Kazuo was forced to count the different coins he had and deal with the concept of coin equivalence.

Work is currently in progress to develop a concrete method of introducing the coin equivalence concept to children with middle-functioning autism.

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