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Manuscripts Accepted for Future Publication in Education and Training in Developmental Disabilities

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Using video prompting to teach cooking skills to secondary students with moderate disabilities. Tara B. Graves, **Belva C. Collins,** John W. Schuster, and Harold Kleinert, Department of Special Education, 229 Taylor Education Building, University of Kentucky, Lexington, KY 40506-0001.

Computer-based video instruction to teach students with intellectual disabilities to verbally respond to questions and make purchases in fast food restaurants. **Linda C. Mechling,** Leslie S. Pridgen, and Beth A. Cronin, Department of Curricular Studies, The University of North Carolina at Wilmington, 601 South College Road, Wilmington, NC 28403-5940.

Using simultaneous prompting for teaching various discrete tasks to students with mental retardation. **Bunyamin Birkan,** Anadolu Universitesi, Engellier Arastirma Enstitusu, Eskisehir, 26470 TURKEY.

Social integration of students with autism in inclusive settings. **E. Amanda Boutot** and Diane P. Bryant, University of Nevada, Las Vegas, Department of Special Education, 4505 Maryland Parkway, Box 453014, Las Vegas, NV 89154-3014.

Using self-monitoring to increase following-direction skills of students with moderate to severe disabilities in general education. **Martin Agran,** Thomas Sinclair, Sandra Alper, Michael Cavin, Michael Wehmeyer, and Carolyn Hughes, Department of Special Education, University of Northern Iowa, 158 SEC, Cedar Falls, IA 50614.

Using a personal digital assistant to enhance the independence of an adolescent with Asperger syndrome. Heather Ferguson, **Brenda Smith Myles,** and Taku Hagiwara, Department of Special Education, University of Kansas, Joseph R. Pearson Building, 5th Floor, 1122 West Campus Road, Lawrence, KS 66045-3101.

Self monitoring: Are young adults with MR and autism able to utilize cognitive strategies independently? **Jennifer B. Ganz** and Jeff Sigafoos, DISCI, COEHD, University of Texas at San Antonio, 6900 North Loop 1604 West, San Antonio, TX 78249.

Improving feeding skills and mealtime behaviors in children and youth with disabilities. **Rita L. Bailey** and Maureen E. Angell, Department of Special Education, Illinois State University, Campus Box 5910, Normal, IL 61790-5910.

Address is supplied for author in boldface type.

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Sensory Issues in Children with Asperger Syndrome and Autism

Brenda Smith Myles and Taku Hagiwara
University of Kansas

Winnie Dunn, Louann Rinner, and Matthew Reese
University of Kansas Medical Center

Abby Huggins and Stephanie Becker
Blue Valley Public Schools

Abstract: The purpose of this study was to examine whether children with Asperger Syndrome and children with autism exhibit difference sensory profiles. The Sensory Profile (Dunn, 1999), completed on 86 individuals with Asperger Syndrome and 86 persons with autism matched for age, revealed differences in three of 23 areas evaluated: (a) Emotional/Social Responses, (b) Emotional Reactivity, and (c) Inattention/Distractibility. Implications regarding these similarities and differences in profile are discussed.

During the past several years, researchers and practitioners have sought to determine commonalities and differences among characteristics of autism and Asperger Syndrome (AS), collectively referred to as autism spectrum disorders (ASD). To date results have been equivocal at best. For example, studies of general clinical characteristics of individuals with autism and AS (Eisenmajer et.al, 1996; Gilchrist, Green, Cox, Rutter, & Le Couteur, 2001; Kurita, 1997; Szatmari, Archer, Fisman, Streiner, & Wilson, 1995) have revealed no consistent significant differences in attributes between the groups. Further, investigations of cognitive profiles (Ehlers et al., 1997; Szatmari, Tuff, Finlayson, & Bartolucci, 1990), neuropsychological and language profiles (Ozonoff, Rogers, & Pennington, 1991; Rinehart, Bradshaw, Moss, Brereton, & Tonge, 2001; Szatmari et al., 1990), and behavioral and psychiatric problems (Ghaziuddin, 2002; Ghazziudin, Alessi, & Greden, 1995; Kim, Szatmari, Bryson, Streiner, & Wilson, 2000; Tonge, Brereton, Gray, & Einfeld, 1999) have yielded equivocal results in differentiating the two disabilities.

Correspondence concerning this article should be addressed to Brenda Smith Myles, University of Kansas, Special Education, 1122 West Campus Road, Room 521, Lawrence, KS 66045-3101.

Despite its global impact on individuals with ASD one area of functioning that has not been compared across autism and AS, is sensory processing. Since Kanner's investigation of individuals with autism in 1943, it has been recognized that children and youth with autism manifest sensory integration problems that include (a) low endurance and tone, (b) poor registration, (c) tactile challenges, (d) fine-motor/perceptual problems, (e) self-regulation, and (f) oral sensory sensitivity (Ayres & Tickle, 1980; Bagnato & Neisworth, 1999; Ermer & Dunn, 1998; Kientz & Dunn, 1997).

Fewer investigations on sensory issues in individuals with AS exist. Asperger (1944) recognized sensory deficits in children with AS in his clinical writings and professionals, parents, and individuals with AS themselves have acknowledged anecdotally that sensory issues are apparent in this disability (Attwood, 1998; Myles, Cook, Miller, Rinner, & Robbins, 2000; Stagnitti, Raison, & Ryan, 1999; Willey, 1999). Despite this discussion, only one empirical article has been published in a peer-refereed journal on sensory issues of persons with AS (Dunn, Myles, & Orr, 2002). In this investigation, Dunn et al. found that children and youth with AS differed from typical peers on 22 of 23 categories identified in the Sensory Profile (Dunn, 1999), a norm-referenced measure that describes responses to sensory events in daily life.

A small database in autism and an even more meager one in AS suggest that sensory differences are a salient part of the disabilities. However, the question of whether specific sensory processing patterns exist that can differentiate the groups has not been investigated. Thus, the purpose of this study was to identify the sensory characteristics of children and youth with autism and AS and further determine whether these characteristics are sufficiently salient to differentiate the two disorders.

Method

Participants

Eighty-six children and adolescents with Asperger Syndrome and 86 individuals with autism, matched by chronological age (mean age: 7 years, 6 months; range = 6 years 9 months to 16 years 8 months), participated. The investigation was a part of an extensive study conducted by a large midwestern university. The 80 male and six female participants with AS had a mean intelligence quotient (IQ) of 98.48 (*SD* = 24.81). IQ was not available for the 80 males and six females with autism; however, their records included scores from the Psychoeducational Profile – Revised (PEP-R; Schopler, Reichler, Bashford, Lansing, & Marcus, 1990). Aggregate score on PEP-R for the children with autism was 22 months (*SD* = 10.34), suggesting that this group was more impaired overall than participants with AS. All participants were Caucasian and had been diagnosed by a licensed psychiatrist or multidisciplinary team in a university-based clinical program using criteria stated in the *Diagnostic and statistical manual of mental disorders – fourth edition* (American Psychiatric Association, 1994).

Instrument

The Sensory Profile is a 125-item questionnaire that describes responses to sensory events in daily life. The caregiver reports on a 5-point Likert scale how frequently the child or adolescent uses a given response to particular sensory events (e.g., always, frequently, occasionally, seldom or never).

Normed on more than 1,000 children without disabilities and 150 children with disabilities (Dunn, 1999), the Sensory Profile measures the degree to which children exhibit problems in (a) sensory processing, (b) modulation, and (c) behavioral and emotional responses– called Section scores. Examiners can also calculate Factor scores, which are clusters of scores derived from a factor analysis study indicating that a child's level of responsivity was an important consideration (i.e., hyporesponsive, hyperresponsive).

The Sensory Profile provides information about the possible contributions of sensory processing to a child's individual performance patterns, provides information about the child's responses to stimuli, and identifies sensory systems that may be contributing to or creating barriers to functional performance. A lower score reflects poorer performance (i.e., a higher rate of behavior, because items are written to reflect potential difficulty with the sensory experience). That is, if a child never engages in a given behavior, he or she obtains a raw score of five, whereas if the child always engages in the behavior, he or she receives a raw score of one.

Using raw scores, Dunn (1999) designed the following classification system for recording children's performance in comparison to a national sample of children without disabilities:

1. Typical Performance - Scores are at or above one standard deviation below the mean. This classification includes the top 84% of the research sample.
2. Probable Difference - This classification indicates questionable areas of sensory processing abilities. Approximately 14% of the research sample had scores between one and two standard deviations below the mean.
3. Definite Difference - Only 2% of the research sample met this classification, which includes scores below two standard deviations below the mean.

Internal consistency estimates (range = .47 to .91) and standard error of measurement (range = 1.0 to 2.8) support instrument reliability. Dunn (1999) also reported on content and construct validity (i.e., convergent, discriminant). Validity findings indicate high

correlations with measures of sensory perception and behavioral regulation. Table 1 provides an overview of the 9 factors and 14 sections assessed by the Sensory Profile.

Procedure

Participants were located through a database of members of a parent support group for families of individuals with AS. Letters were sent to members informing them of the study. Interested parties contacted the researchers expressing their willingness (and that of their child) to participate. Information regarding children with autism was gathered retrospectively from assessment files at the child developmental center at the participating university.

Assessments were administered individually in a clinical setting. Testing sessions took place in a small classroom with work tables, adequate lighting and minimal auditory and visual distractions. All assessments were given by clinicians and graduate students enrolled in an autism/AS graduate program. The graduate students had extensive experience administering the assessment measures as members of an AS/autism assessment team. In addition, they had received in-depth training in AS and autism through academic study and practicum experiences.

Data Analysis

Two multivariate analyses of variance (MANOVA) were conducted to identify sensory differences in individuals with AS and children and youth with autism. The first MANOVA addressed comparisons on the Sensory Profile Section scores and the second addressed differences on the Factor scores.

Results

The study was designed to compare sensory processing characteristics of children and youth with AS to those of individuals with autism. Specifically, the investigation sought to determine whether the (a) sensory processing, (b) modulation, (c) behavioral and emotional responses, and (d) responsiveness characteristics as identified on the Sensory Profile (Dunn, 1999) differed among the two groups.

Section scores of the two groups, compared using a MANOVA, were statistically significant ($F = 2.84$; $p < .05$ by Roy's Largest Root Criterion [Kendall, 1999]; power = .99; effect size = .29). Of 14 possible statistical comparisons, one was significantly different (using the Bonferroni-corrected probability $p < .003$), with participants with AS performing more poorly than the children with autism. Specifically, differences existed in the factor score Emotional/Social Responses ($F = 25.62$; $p < .003$). Tables 2 and 3 show the means and standard deviations for the two groups on each of the section and factor scores.

The MANOVA using Sensory Profile Factor scores was found to be significant ($F = 4.39$, $p < .05$ by Roy's Largest Root Criterion [Kendall, 1999]). Thus, the power estimate of .99 and an effect size .24 suggest that differences in this study could be clinically meaningful. Of nine possible statistical comparisons, two were significantly different (using the Bonferroni-corrected probability $p < .005$). In both areas, Emotionally Reactive and Inattention/Distractibility, individuals with AS received a lower score than their counterparts with autism (see Tables 4 and 5), indicating poorer performance.

Discussion

Findings from this study contribute additional evidence to the overall picture of autism and AS. In previous studies (Dunn, Myles et al., 2002; Kientz & Dunn, 1997), researchers reported on significant differences in sensory processing and related behaviors in comparisons of children with autism and children with AS to age-matched neuro-typical peers. The present study adds to the emerging picture by illustrating some significant differences between these two pervasive disorders, suggesting that the sensory processing patterns of autism and AS are distinct in some areas.

The first area of distinction, emotional/social responsiveness is characterized by two significant scores (i.e., Emotional/ Social Responses and Emotionally Reactive) on the Sensory Profile. The authors describe the behaviors represented by these items as "psychosocial coping strategies," or products of sensory processing (Dunn, 1999). It is important here to remember that both children with

TABLE 1

Sensory Profile Item Categories

Sensory Processing

Auditory Processing. The items included in the Auditory section measure the child's responses to things heard (e.g., "Is distracted or has trouble functioning if there is a lot of noise around").

Visual Processing. The Visual section includes items that measure the child's responses to things seen (e.g., "Is bothered by bright lights after others have adapted to the light").

Vestibular Processing. This section measures the child's responses to movement (e.g., "Becomes anxious or distressed when feet leave the ground").

Touch Processing. The Touch section measures the child's responses to stimuli that touch the skin (e.g., "Becomes irritated by shoes or socks").

Multisensory Processing. Items in this section measure the child's responses to activities that contain a combined sensory experience (e.g., "Seems oblivious within an active environment").

Oral Sensory Processing. The oral Sensory section measures the child's responses to touch and taste stimuli to the mouth (e.g., "Limits self to particular food textures/temperatures").

Modulation

Sensory Processing Related to Endurance/Tone. This section measures the child's ability to sustain performance (e.g., "Poor endurance/tires easily").

Modulation Related to Body Position and Movement. Items in this section measure the child's ability to move effectively (e.g., "Takes movement or climbing risks during play that compromise personal safety").

Modulation of Movement Affecting Activity Level. This section measures the child's demonstration of activeness (e.g., "Spends most of the day in sedentary play").

Modulation of Sensory Input Affecting Emotional Responses. These items measure the child's ability to use body senses to generate emotional responses (e.g., "Rigid rituals in personal hygiene").

Modulation of Visual Input Affecting Emotional Responses and Activity Level. Items in this section measure the child's ability to use visual cues to establish contact with others (e.g., "Stares intensively at objects or people").

Behavioral and Emotional Responses

Emotional/Social Responses. Items in this section indicate the child's psychosocial coping strategies (e.g., "Has fears that interfere with daily routine").

Behavioral Outcomes of Sensory Processing. Items in this section indicate the child's ability to meet performance demands (e.g., "Has difficulty tolerating changes in plans and expectations").

Items Indicating Thresholds for Response. This section includes items that indicate the child's level of modulation (e.g., "Jumps from one activity to another so that it interferes with play").

Factor Scores

Sensation Seeking. The items included in this factor reflect the child's interest in and pleasure with sensory experiences in everyday life.

Emotionally Reactive. The items included in this factor reflect the child's affective responses to sensory experiences in every day life.

Low Endurance/Tone. The items included in this factor reflect the child's ability to use muscle tone to support self while engaging in activity.

Oral Sensory Sensitivity. The items included in this factor reflect the child's responses to textures, tastes and smells, particularly related to foods.

Inattention/Distractibility. The items included in this factor reflect the child's tendency to be pulled away from activities due to external stimuli, particularly sounds.

Poor Registration. The items included in this factor reflect the child's tendency to miss cues from sensory experiences in everyday life.

Sensory Sensitivity. The items included in this factor reflect the child's level of detection of movement stimuli during everyday life experiences.

Sedentary. The items included in this factor reflect the child's tendency to be passive during everyday life.

Fine Motor/Perceptual. The items included in this factor reflect the child's ability to use hands.

TABLE 2

MANOVA Results for Section Scores on the Sensory Profile

Section	*F*	*p*	*Power*
Auditory Processing	7.14	.009	.75
Visual Processing	.64	.443	.12
Vestibular Processing	.55	.46	.11
Touch Processing	7.37	.008	.77
Multisensory Processing	.47	.50	.10
Oral Sensory Processing	.71	.40	.13
Sensory Processing Related to Endurance/Tone	.74	.39	.14
Modulation Related to Body Position and Movement	.73	.40	.14
Modulation of Movement Affecting Activity Level	1.44	.23	.22
Modulation of Sensory Input Affecting Emotional Responses and Activity Level	7.09	.009	.75
Modulation of Visual Input Affecting Emotional Responses and Activity Level	1.04	.31	.17
Emotional/Social Responses	25.62	<.001**	1.00
Behavioral Outcomes of Sensory Processing	2.85	.094	.39
Items Indicating Thresholds for Response	1.41	.24	.22

** Statistical significance.

autism and children with AS differ significantly from their peers without disabilities in this area. The present finding adds important information by illustrating that children with AS are significantly more challenged in social-emotional responsiveness than their counterparts with autism. Indeed, it is possible that their emotional/social responses are in some way related to the tantrums, rage, and meltdowns often exhibited by children and youth with AS (Myles & Southwick, 1999; Myles & Adreon, 2001). That is, while individuals with

TABLE 3

Sensory Profile Section Means and Standard Deviations for Participants with Autism and Those with Asperger Syndrome

Section	*AS*	*Autism*
Auditory Processing	23.92 (5.22)	26.59 (5.37)
Visual Processing	31.15 (5.91)	32.08 (6.50)
Vestibular Processing	44.58 (6.21)	43.71 (6.22)
Touch Processing	61.03 (11.81)	66.75 (10.25)
Multisensory Processing	22.69 (4.00)	22.20 (3.66)
Oral Sensory Processing	41.48 (10.35)	43.18 (10.93)
Sensory Processing Related to Endurance/Tone	32.16 (8.92)	33.69 (9.97)
Modulation Related to Body Position and Movement	38.36 (6.86)	39.41 (6.20)
Modulation of Movement Affecting Activity Level	19.95 (3.87)	20.88 (4.38)
Modulation of Sensory Input Affecting Emotional Responses and Activity Level	11.89 (2.91)	13.39 (3.09)
Modulation of Visual Input Affecting Emotional Responses and Activity Level	12.47 (2.08)	12.90 (2.45)
Emotional/Social Responses	47.84 (10.48)	56.78 (8.70)
Behavioral Outcomes of Sensory Processing	16.08 (4.00)	17.35 (3.97)
Items Indicating Thresholds for Response	10.65 (2.52)	11.22 (2.56)

TABLE 4

MANOVA Results for Factor Scores on the Sensory Profile

Section	*F*	*p*	*Power*
Sensation Seeking	.002	.963	.05
Emotionally Reactive	31.30	<.001**	1.00
Low Endurance/Tone	1.77	.19	.26
Oral Sensory Sensitivity	2.45	.120	.34
Inattention/Distractibility	12.38	.001**	.94
Poor Registration	5.93	.016	.68
Sensory Sensitivity	.76	.384	.14
Sedentary	2.75	1.00	.38
Fine-Motor/Perceptual	.006	.938	.05

** statistical significance.

autism and those with AS both have sensory processing problems, sensory overload as represented in the behavioral responses included in these sections of the Sensory Profile are more likely to occur with persons who have AS.

There are several possible interpretations of this finding. First, the noted difference may reflect the higher awareness that children with AS have of their own behaviors compared to children who have autism. Thus, even though children with AS lack insight and sometimes have an inability to adjust a response even with feedback, they do express their ability to notice differences between themselves and others, particularly during adolescence.

Second, the higher rate of social/emotional behavior may reflect the greater interaction and language capacity of children with AS. Compared to children with autism, rules can be oblivious to people and contexts which, in turn, can reduce their responsiveness to environmental stimuli and cues. Thus, even though their responses are extreme and frequently maladaptive (as the scores illustrate), children with AS are responding to the environment (including people) at a higher rate than children with autism.

As mentioned, the "Inattention/Distractibility" score from the factor structure was also significantly different between the groups of participants, with children who have AS having more difficulty with attention than children with autism. When examining individual items that make up this factor, the items come from the Auditory Processing and Multisensory Processing sections of the Sensory Profile. Specifically, all items in the Inattention/Distractibility factor score require auditory processing. In addition, the Auditory Processing section showed a contrast between the groups ($F = 7.14$, $p = .009$, power = .75) as well, suggesting that auditory processing is difficult for children with AS, and that it is associated with attentional challenges.

Auditory stimuli are transient; this is in contrast to visual stimuli, for example, which remain available to the person across time. Perhaps children who have AS have a particularly difficulty time capturing auditory information during the exact moment when it is available; across time, missing more and more auditory input can, create confusion about expecta-

TABLE 5

Sensory Profile Factor Scores Means and Standard Deviations for Participants with Autism and Those with Asperger Syndrome

Section	*AS*	*Autism*
Sensation Seeking	59.59 (12.37)	59.50 (9.33)
Emotionally Reactive	40.49 (10.51)	50.63 (10.64)
Low Endurance/Tone	33.06 (8.64)	35.13 (9.50)
Oral Sensory Sensitivity	29.93 (8.30)	32.28 (9.22)
Inattention/Distractibility	19.44 (4.40)	22.04 (4.23)
Poor Registration	28.74 (4.39)	30.94 (6.04)
Sensory Sensitivity	15.44 (3.76)	15.99 (3.50)
Sedentary	10.09 (4.28)	11.31 (4.31)
Fine-Motor/Perceptual	9.29 (3.22)	9.25 (3.34)

tions. There may be a relationship between this difficulty with auditory processing and the rigidity children with AS exhibit in their social interactions as well. For example, if children are missing parts of the auditory message, they may have a greater tendency to latch on to the parts that they have been able to capture, placing greater emphasis on these captured parts than is appropriate to the overall situation. In this scenario, children with AS can appear rigid and perseverative.

A final area that may be significant to consider for education, community, and home situations is the difference in the Touch Processing scores. Both groups, children with AS and children with autism (Dunn, 1999; Kientz & Dunn, 1997), demonstrate difficulty with touch processing compared to typical peers. From this study, it appears that children with AS had more difficulty with touch processing than children with autism. Thus, while F scores did not reach statistical significance, raw score means fell in the "Definite Difference" category for children with AS (i.e., more than two standard deviations from the mean for typical children) and in the "Probable Difference" category for children with autism (i.e., between one and two standard deviations from the mean for typical children). Since case reports of children with AS include issues with body awareness and sensitivity to touch (Dunn, Saiter, & Rinner, 2002; Myles et al., 2000), this difference might be important to consider both for intervention planning and in future studies of children with pervasive developmental disorders. That is, when children receive inaccurate or unreliable information from the surface of their skin, this can contribute to distortions in body perception, leading to inaccurate planning for movements (Dunn, 1999). Difficulties with touch processing, therefore, might be contributing to the clumsiness and awkwardness often seen in children with AS.

It appears that a database is emerging that clearly documents the sensory challenges experienced with individuals with AS. This study and its predecessor revealed that children with AS, while having sensory issues that differentiate them from their neurotypical peers (Dunn, Myles et al., 2002), show marked similarities with the profile of children with autism. Thus, it seems that commonalities exist between the two populations despite differences in functioning levels. Differences that exist represent behavioral and attentional challenges that are more striking for children and youth with AS. Future research is needed to determine the validity of these findings to (a) determine if specific sensory issues can serve as a marker to differentiate children with autism from those with AS and (b) to aid practitioners, parents, and researchers in better understanding the complex needs of children and youth with AS.

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Collaboration Among Parents and Professionals with Discrete Trial Training in the Treatment for Autism

Sandra D. Devlin and Melissa M. Harber
Mississippi State University

Abstract: This study evaluates impact of collaborative efforts of parents and school professionals in the treatment of autism in a five-year-old boy. Method of treatment was discrete trial training across settings (e.g., home and school) and change agents were the child's parents, siblings, special education teacher, resource teacher, and speech pathologist.

Typical characteristics of autism include pervasive behavioral deficits and excesses resulting in inappropriate behavioral patterns. Behavioral deficits may be observed in the child's speech and language (Schreibman, 1988), social skills (Borden & Ollendick, 1994; Rutter, 1978; Schreibman), and attention (Lovaas, Koegel, & Schreibman, 1979; Schreibman). Behavioral excesses observed may include self-injurious behavior (Carr, 1977; Lovaas & Simmons, 1969), self-stimulatory behavior (Lovaas, Litrownik, & Mann, 1971; Lovaas, Newsom, & Hickman, 1987), and perseverative behaviors (Rutter, 1978). Inappropriate behavioral deficits and excesses have a negative impact on social and academic functioning (Ritvo & Freeman, 1978; Schreibman & Charlop-Christy, 1998).

Although the behaviors associated with a diagnosis of autism are somewhat severe, research indicates that through use of applied behavior analysis, children can learn to appropriately function in their environments (Anderson, Avery, DiPietro, Edwards, & Christian, 1987; Birnbrauer & Leach, 1993; Fenske, Zalenski, Krantz, & McClannahan, 1985; Lovaas, 1987; McEachin, Smith, & Lovaas, 1993; Perry, Cohen, & DeCarlo, 1995).

Lovaas (1987) designed a behavioral intervention paradigm consisting of systematic discrimination training that involves intensive one-to-one, repetitive practice, discrete-trial training. The trainer identifies the task to be taught and using systematic discrimination training, teaches the task (Lovaas). Specifically, the trainer presents a discriminative stimulus to the child (e.g., "Do this." or "Point to dog."). The trainer simultaneously, or immediately after presenting the discriminative stimulus, presents a prompt (e.g., taking the child's hand and physically guiding the child's hand and finger to point to the dog.) This step is to be faded and eliminated with the child's increased skill acquisition. The child provides a response. The trainer then provides the child with a contingent immediate consequence (e.g., immediately praise for correct responses (Lovaas); immediately prompt the child to provide the correct response (Scheuermann & Webber, 2002); or provide aversive such as "no" or turning head away for incorrect responses (Lovaas)). The trainer provides a brief, 3- to 5-second interval between trials (Lovaas). Numerous studies have demonstrated the effectiveness of behavioral interventions in the home and school (Anderson et al., 1987; Birnbrauer & Leach, 1993; Fenske et al., 1985; Lovaas; Perry et al., 1995).

Several studies have evaluated effectiveness of home-based behavioral intervention for young children with autism. Lovaas (1987) reported on effects of behavior modification treatment for two groups of similarly representative children with autism. Lovaas compared effects of an intensive, 40 hours per week of one-to-one behavioral treatment at home, at school, and in the community (ex-

Correspondence concerning this article should be addressed to Sandra D. Devlin, Mississippi State University, Box 9727, Mississippi State, MS 39762-5247.

perimental group), to less than 10 hours per week of one-to-one behavioral treatment at home, at school, and in the community (control group). Results indicated that 47% of children in the experimental treatment group and 2% of children in the control group achieved "normal" intellectual (i.e., IQ scores in the normal range) and educational (i.e., successful first grade performance) functioning. Forty percent of children in the experimental treatment group and 45% of children in the control group were assessed to be "mildly retarded" and placed in special education classes. Only 2% of children in the experimental treatment group were assessed to be "severely retarded," however, 53% of children in the control group were assessed to be "severely retarded." This study suggests that early, intensive, home-based behavioral intervention provides the best opportunity for optimal functioning in children with autism. Several attempts have been made to replicate this research.

Anderson and colleagues (1987) reported that systematic use of behavioral teaching techniques and treatment procedures, intensive training conducted in the child's natural home, and extensive parent training resulted in most of the 14, 18- to 64-month-old participants, demonstrating significant gains in language, self-care, and social and academic development. Standardized measures were used to conduct assessment as well as single subject methodology. While substantial gains were noted in the Anderson and colleagues study, similar to the gains noted in the Lovaas (1987) study, there were several major differences in the behavioral intervention design. Unlike Lovaas, Anderson and colleagues used no physically aversive consequences in treatment. Additionally, participants received only 15 to 25 hours of intensive behavioral teaching from trained parents and teachers in the home (Anderson), in contrast to 40 hours of intensive behavioral teaching (Lovaas).

Further research conducted by Birnbrauer and Leach (1993) replicated the intensive early intervention program designed by Lovaas in 1987. However, differences in the behavioral intervention included fewer hours per week of intensive behavioral training and no use of physically aversive consequences in treatment (Birnbrauer & Leach). Participants of the Birnbrauer and Leach study were children with autism and severe developmental disabilities, ranging in age from 24 to 48 months. An experimental group of nine children received an average of 18.72 hours of one-to-one instruction from trained parents and volunteers who were supervised by applied behavior analysis specialists. A control group of five children did not receive behavioral intervention. At the end of a 2-year period, standardized assessments showed that four children in the experimental group had made substantial gains as evident by IQ scores above 80, whereas they were previously judged to be "untestable." Language and adaptive behavior assessments also indicated considerable improvements. Four children from the experimental group made moderate improvements, while one made only minimal gains. Only one child in the control group made substantial gains in language and adaptive functioning, but not in intellectual functioning. One child in the control group made moderate improvements, while the other three made few or minimal gains.

McEachin et al. (1993) conducted research involving intensive behavioral intervention with an experimental group of 19 preschool-aged children who were autistic and 19 similar preschool-aged children who did not receive behavioral intervention. By age 7, children who received intensive behavioral intervention had achieved less restrictive school placements and higher IQ scores than their counterparts who did not receive intensive behavioral intervention. Follow-up revealed that by age 13, gains of the experimental group had maintained, indicating the behavioral treatment may produce long-term substantial gains for young children with autism.

Research indicates that because children with autism exhibit specific skills deficits, it is necessary to assess the child's current functioning across those areas, such as attending skills, imitation skills, receptive and expressive language skills, pre-academic skills and self-help skills, before beginning a behavioral intervention (Taylor & McDonough, 1996). Assessment of skills may be conducted by direct observation, interviews with parents, and/or by formal measurements developed specifically to assess behaviors associated with autism (Scheuermann & Webber, 2002). The child

must be able to demonstrate a specific skill upon verbal request, demonstrate a skill without assistance, demonstrate a skill reliably over time, across settings, and with various stimuli (Taylor & McDonough). According to Taylor and McDonough once a skills assessment has been conducted, skills that the child lacks become targets for instruction and are developed into a teaching program. When developing a program, the child must exhibit necessary prerequisite skills, and acquire the skill within a reasonable amount of time. Skills taught in the program must be developmentally and age appropriate, be prerequisite for future skills, and be used throughout the day (Scheuermann & Webber; Taylor & McDonough). Skills taught in the program must also generalize to other situations and people across settings (Scheuermann & Webber, 2002; Taylor & McDonough, 1996).

Goals and objectives must be established as well as skill acquisition criteria prior to program implementation (Scheuermann & Webber, 2002). According to Scheuermann and Webber and Anderson et al. (1996), the individualized sequences of skills become the goals, which are broken down into behavioral objectives. The skill is considered acquired when the child responds correctly to eight out of 10 trials during three consecutive sessions without prompts. Generalization of the discriminative stimuli occurs if the child performs the response under different conditions, but in response to a stimulus similar to the discriminative stimulus. According to research, once the behavior is mastered, and similar behaviors emerge, response generalization has occurred. The skill is considered to maintain if the child can perform the response at 80% over a long period of time, without the skill having to be re-taught (Scheuermann & Webber).

Given the parameters of time and intensity of behavioral interventions employed to treat behaviors associated with autism discussed in the previous studies (Anderson et al., 1987; Birnbrauer & Leach, 1993; Fenske et al., 1985; Lovaas, 1987; McEachin et al., 1993; Perry et al., 1995; Scheuermann & Webber, 2002; Taylor & McDonough, 1996), it is important to understand the degree to which behavioral interventions must be employed to ensure successful mastery of specific skills. The purpose of this study was to assess effectiveness of implementing a behavioral intervention consisting of fewer hours of intensive discrete trial training being implemented by parents, special education teachers, a resource teacher, and a speech/language pathologist under supervision of a trained applied behavior analysis specialist.

Method

Participants

Participants were a 5-year-old Caucasian boy diagnosed with autism, and the treatment agents: the child's parents, special education teachers, resource teacher, and speech/language pathologist. An applied behavior analysis specialist supervised the treatment agents. The research takes place in a rural southeastern town in the child's home, in his special education classroom, and in his speech/language pathologist's classroom. The child was assessed by the local school district for special education services at the age of 45 months when parents observed delays in development, speech and language. The child was then referred to the child development clinic at a local university medical center, which reported a diagnosis of childhood autism and referred the child to an applied behavior analysis specialist.

Materials

The Battelle Developmental Screening Inventory was administered to screen for current personal/social, adaptive, gross and fine motor, receptive and expressive, and cognitive problems. Project Memphis was administered to assess fine motor, person/social, language and perceptual/cognitive functioning. The Battelle Developmental Inventory was administered to assess personal/social, adaptive, fine motor, and cognitive functioning. The Goldman-Fristoe Test of Articulation was administered to assess language. The Gilliam Autism Rating Scale was administered to assess behaviors associated with a diagnosis of autism such as stereotyped behaviors, communication, social interaction, and developmental functioning. No other information (e.g., diagnostic instrument, date of testing) from the child

TABLE 1

Beginning Curriculum Guide

	Assessment #1	*Assessment #2*
Attending Skills		
Sits in chair independently	X	X
Makes eye contact in response to name	X	X
Makes eye contact when given "Look at me"	X	X
Responds to "No hands"	—	X
Imitation Skills		
Imitates gross motor movements	X	X
Imitates actions with objects	X	X
Imitates fine motor movements	X	X
Imitates oral motor movements	X	X
Receptive Language		
Follows 1-step instructions	—	X
Identifies body parts	—	X
Identifies objects	—	X
Identifies pictures	—	X
Identifies familiar people	—	X
Follows verb instructions	—	X
Identifies verbs in pictures	—	—
Identifies objects in the environment	—	X
Points to pictures in a book	—	—
Identifies objects by function	—	—
Identifies possessions	—	—
Identifies environmental sounds	—	—
Expressive Language		
Points to desired items in response to "What do you want?"	X	X
Points to desired items spontaneously	X	X
Imitates sounds and words	X	X
Labels objects	—	X
Labels pictures	—	X
Verbally requests desired items	—	—
States/gestures yes/no for preferred/nonpreferred items	—	X
Labels familiar people	—	X
Makes a choice	—	X
Reciprocates greetings	—	X
Answers social questions	—	—
Labels verbs in pictures, others, & self	—	—
Labels objects by function	—	—
Labels possessions	—	—
Pre-academic skills		
Matches		
Identical objects	—	X
Identical pictures	—	X
Objects to pictures	—	X
Pictures to pictures	—	—
Colors	—	X
Shapes	—	—
Letters	—	—
Numbers	—	—
Nonidentical objects	—	—
Objects by association	—	—
Completes simple activities independently	—	X
Identifies colors	—	X

TABLE 1—(*Continued*)

	Assessment #1	*Assessment #2*
Pre-academic skills (*continued*)		
Identifies shapes	—	X
Identifies letters	—	X
Identifies numbers	—	X
Counts by rote to 10	—	—
Counts objects	—	—
Self-help skills		
Drinks from a cup	X	X
Uses a fork and spoon when eating	X	X
Removes shoes	X	X
Removes socks	X	X
Removes pants	X	X
Removes shirt	X	X
Uses napkin/tissue	X	X
Is toilet trained for urination	X	X

development clinic at a local university medical center was available.

Procedure

The child's program was developed by assessing current level of functioning, establishing placement goals, and developing an activity/skill list for reaching goals. The child's instructional objectives were determined using the Curriculum Guide provided by Taylor and McDonough (1996). Since the curriculum itself was used for assessment purposes, this technique is referred to as curriculum based assessment. Observational recording was used to measure performance on given objectives from the curriculum and the child was assessed as to whether he could or could not perform the appropriate response with or without prompting. Ongoing assessment using curriculum based measurements were conducted to determine progress and results related directly to the instructional objectives. The program was implemented using applied behavior analysis. Teachers, therapists, and family members were trained accordingly and used discrete trial training to teach instructional objectives.

Discrete trial training involved four parts; the trainer presents a discriminative stimulus, the child responds, the trainer provides an immediate consequence, and a brief between-trial interval pause is taken.

Receptive and expressive language, conversation, and sentences, grammar, and syntax were taught by discrete trial training. A speech/language pathologist at the local elementary school provided one-to-one language therapy using discrete trial training, three times per week for one hour each day. Data were recorded on data collection sheets from the Curriculum Guide (Taylor & McDonough, 1996).

Special education teachers used discrete trial training to teach applicable skills in a special education classroom at the local elementary school. The child's special education teacher employed use of visual supports and manipulatives and offered opportunities to engage in center-based activities. Data were recorded on data collection sheets (Taylor & McDonough, 1996).

Extended school year was provided throughout the summer months in order to maintain progress and eliminate possible regression. Data were recorded throughout the summer months and presented on data collection sheets (Taylor & McDonough, 1996). Discrete trial training occurred between 20 and 24 hours per week. Teachers, therapists, and parents met weekly to compare data collected in an effort to move smoothly from objective to objective. Communication with the applied behavior analysis specialist was also maintained, as well as regularly scheduled meetings to evaluate current data, plan for

TABLE 2

Intermediate Curriculum Guide

	Assessment #1	*Assessment #2*
Attending Skills		
Sustains eye contact for 5 seconds in response to name	X	X
Makes eye contact in response to name while playing	X	X
Makes eye contact in response to name from a distance	—	X
Asks "What?" when name is called	—	X
Imitation Skills		
Gross motor from a standing position	X	X
Sequenced gross motor movements	X	X
Sequenced actions with objects	X	X
Actions paired with sounds	—	—
Block patterns	—	X
Copies simple drawings	—	X
Receptive Language		
Identifies rooms	—	—
Identifies emotions	X	X
Identifies places	—	—
Follows two-step instructions	—	—
Gives two objects	—	X
Retrieves objects out of view	X	X
Identifies attributes	—	—
Identifies community helpers	—	—
Pretends	X	X
Identifies categories	—	—
Identifies pronouns	—	—
Follows directions with prepositions	—	—
Identifies object in view when described	—	—
Places sequence cards in order	—	X
Identifies gender	—	—
Identifies item that is missing	—	—
Answers *wh*-questions about objects & pictures	—	—
Answers yes/no in response to questions about objects/actions	—	—
Names object by touch	—	—
Expressive Language Skills		
Imitates 2- and 3-word phrases	—	X
Requests desired items in a sentence in response to "What do you want?"	—	X
Requests desired items spontaneously in a sentence	—	—
Calls for parent from a distance	—	X
Labels objects based on function	—	—
Labels function of objects	—	—
Labels & points to body part according to function	—	—
Labels function of body parts	—	—
Labels places	—	—
Labels emotions	—	—
Labels categories	—	—
Uses simple sentences	—	X
Reciprocates information	—	—
States "I don't know" when asked to label unknown objects	—	—
Asks *wh*-questions: "What's that?" & "Where is. . . .?"	—	—
Labels prepositions	—	—
Labels pronouns	—	—
Answers general knowledge questions	—	—
Labels gender	—	X

TABLE 2—(*Continued*)

	Assessment #1	*Assessment #2*
Expressive Language Skills (*continued*)		
Describes pictures in a sentence	—	X
Describes objects in view using attributes	—	—
Recalls immediate past experience	—	—
Answers "Where. . ..?" questions	—	—
Names what belongs in rooms	—	—
Labels functions of rooms	—	—
Labels function of community helpers	—	—
Answers "When. . .?" questions	—	—
Describes sequence of pictures	—	—
Delivers a message	—	—
Role plays with puppets	—	X
Offers assistance	—	X
Pre-academic Skills		
Matches items from the same category	—	—
Gives specified quantity of items	—	—
Matches number to quantity	—	—
Matches uppercase to lowercase letters	—	X
Matches identical words	—	—
Identifies more/less	—	—
Sequences numbers/letters	—	—
Completes simple worksheets	—	X
Copies letters & numbers	X	X
Identifies written name	—	—
Draws simple pictures	X	X
Writes name	X	X
Pastes/glues	X	X
Cuts with scissors	X	X
Colors within a boundary	—	—
Self-help skills		
Puts on pants	—	X
Puts on shirt	—	X
Puts on coat	—	X
Puts on shoes	—	X
Puts on socks	—	X
Washes hands	X	X
Is toilet trained for bowel movements	X	X
Self-initiates for bathroom	—	X

future programming, and address any problematic issues.

All change agents involved in this team began discrete trial training in highly structured one-to-one settings. Upon mastery of basic skills, discrete trials were begun in the natural environment (e.g., while walking down the hall at school, at the grocery store, in the car, etc.) to promote generalization and teach new skills. Structured sessions of discrete trials continued to be implemented in the school and home, as well.

Results

Curriculum based assessment using the Beginning Curriculum Guide (Table 1) indicated that William, at 45 months had mastered three attending skills (i.e., sits in a chair independently, makes eye contact in response to name, makes eye contact when given the instruction "Look at me"), four imitation skills (i.e., gross motor movements, actions with objects, fine motor movements, oral motor movements), one receptive language skill

TABLE 3

Beginning Curriculum Guide Skills; Pre and Post Intervention Summary

Skill Category	*Number of Skills in Category*	*Percentage of Skills Present: Pre-Intervention*	*Percentage of Skills Present:Post-Intervention*	*Percentage Shift*
Attending	4	75%	100%	25%
Imitation	4	100%	100%	0%
Receptive Language	12	0%	58%	58%
Expressive Language	14	21%	64%	43%
Pre-Academic	17	0%	53%	53%
Self Help	8	100%	100%	0%
Total	59	31%	69%	39%

(i.e., identifies familiar people), three expressive language skills (i.e., points to desired items in response to "What do you want?", points to desired items spontaneously, imitates sounds and words), and eight self-help skills (i.e., drinks from a cup, uses fork and spoon when eating, removes shoes, removes socks, removes pants, removes shirt [inconsistently], uses napkin/tissue, is toilet-trained for urination).

In addition to the previously listed mastered beginning skills, the child also had mastered items from the Intermediate Curriculum Guide: two attending skills (i.e., sustains eye contact for 5-seconds in response to name, makes eye contact in response to name while playing), three imitation skills (i.e., gross motor movements from a standing position, sequenced gross motor movements, sequenced actions with objects), three receptive language skills (i.e., identifies emotions, retrieves objects out of view, pretends), five pre-academic skills (i.e., copies letters and numbers, draws simple pictures, writes name, pastes/glues, cuts with scissors) and two self-help skills (i.e., washes hands, is toilet trained for bowel movements). Curriculum based assessment also revealed mastery of one advanced imitation skill (i.e., imitates peer play).

Within 28 weeks of behavioral intervention, significant improvements were visible (Table 1). On curriculum based measurement of the Beginning Curriculum, William exhibited mastery of all four attending skills (i.e., responds to the direction "No hands." in addition to previously mastered items), all four imitation skills (i.e., all were mastered at initial assessment), seven more receptive language skills (i.e., follows one-step instructions, identifies body parts, identifies objects, identifies pictures, follows verb instructions, identifies objects in movements, points to pictures in a book), six more of the expressive language skills (i.e., labels objects, labels pictures, verbally requests desired items, states or gestures yes/no for preferred/nonpreferred items, labels familiar people, makes a choice), more pre-academic skills (i.e., matches identical objects, identical pictures, and colors, completes simple activities independently, identifies colors, identifies shapes, identifies letters, and identifies numbers), and maintained mastery for all previously mastered self-help skills.

On the Intermediate Curriculum Guide (Table 2), William exhibited mastery of two more attending skills (i.e., makes eye contact in response to name from a distance, asks "what" when name is called), two more imitation skills (i.e., imitates block patterns, copies simple drawings), two more receptive language skills (i.e., gives two objects, places sequence cards in order), seven more expressive language skills (i.e., imitates two- and three-word phrases, requests desired items in response to "What do you want?", uses simple sentences, describes pictures in a sentence, labels gender, role plays with puppets, offers assistance), two more pre-academic skills (matches uppercase to lowercase letters, completes simple worksheets), and now exhibits all of the self-help skills (puts on pants, shirt, coat, shoes, socks, self-initiates for bathroom).

William has also mastered items on the Advanced Curriculum Guide including one attending skill (i.e., makes eye contact during conversation), one more imitation skill (i.e.,

TABLE 4

Intermediate Curriculum Guide Skills; Pre and Post Intervention Summary

Skill Category	*Number of Skills in Category*	*Percentage of Skills Present:Pre-Intervention*	*Percentage of Skills Present:Post-Intervention*	*Percentage Shift*
Attending	4	50%	100%	50%
Imitation	6	50%	83%	33%
Receptive Language	19	16%	26%	11%
Expressive Language	31	0%	26%	26%
Pre-Academic	15	33%	47%	13%
Self Help	7	29%	100%	71%
Total	82	18%	44%	26%

imitates verbal responses of peers), and one expressive language skill (retells a story). William's mastery of desired Beginning Curriculum Guide skills improved from 31% to 69% (Table 3). Desired Intermediate Curriculum Guide skills improved from 18% to 44% (Table 4).

Discussion

The combined interventions of discrete trial training, collaboration, and extended school year produced a meaningful increase in desired skills.

Findings obtained support the position that young children with autism can obtain significant gains through use of applied behavior analysis with the application of discrete trial training occurring between twenty and twenty-four hours per week across settings. Former studies utilizing discrete methodology have found gains to be significant when the training occurred between thirty and forty hours per week (Lovaas, 1987; McEachin et al., 1993).

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Teaching Social Problem Solving to Individuals with Mental Retardation

Steven A. Crites
Indiana-Purdue University Fort Wayne

Caroline Dunn
Auburn University

Abstract: The purpose of this study was to determine effectiveness of a problem-solving curriculum for transition-age students with mental retardation. The interactive training program Solving Your Problems (Browning, n.d.) was used to teach a five-step process for solving problems. Results indicate participants in the training group were able to use the five-step problem solving process to solve problem situations. Additionally, members of the training group scored higher than those in the control group on a problem-solving curriculum measure and were able to generate more alternative solutions to novel problem situations. There was some evidence of generalization of the five-step process to novel problem situations. Participant feedback on training was positive.

Improving social behavior of people with mental retardation has long been a goal of researchers (Wehmeyer & Kelchner, 1994). In a review of intervention strategies to improve social skills in the employment setting, Huang and Cuvo (1997) found that treatment procedures could be grouped into six categories: (a) modeling, (b) consequence management, (c) peer-mediated strategies, (d) self-management training, (e) social skills training packages, and (f) process training. Each of these treatment procedures employs different strategies to teach skills.

Many have used behavior modification techniques (e.g., Breen, Hating, Pitts-Conway, & Gaylord-Ross, 1985; Karlan & Rusch, 1982; Matson & Senatore, 1981; Morgan & Salzberg, 1992). These traditional social skill training approaches focus on teaching skills needed to interact, and have been effective in teaching skills in the classroom.

Unfortunately, this skill training has not resulted in increased social competence or employment outcomes. The employment rate for individuals with mental retardation has remained at about 60% for the last four decades (Benz, Yovanoff, & Doren, 1997; Bobroff, 1956; Dinger, 1961; Stanfield, 1973).

Correspondence concerning this article should be addressed to Steven A. Crites, Indiana University-Purdue University Fort Wayne, School of Education, Department of Professional Studies - Neff 250K, 2101 E. Coliseum Blvd., Fort Wayne, IN 46805-1499. E-mail: critess@ipfw.edu

Greenspan and Granfield (1992) developed a model of social competence that may explain why traditional social skills training programs have not resulted in increased social competence and employment outcomes for individuals with mental retardation. According to Greenspan and Granfield, there are two intellectual aspects of social competence, practical intelligence and social intelligence. Social intelligence is made up of social skills and social awareness. The training approaches described above (i.e., modeling, consequence management, peer-mediated strategies, self-management training, social skills training packages) increase social skills but do not necessarily increase social awareness. To effectively increase social competence, training procedures must address the social-cognitive abilities of the individual with mental retardation as well (Siperstein, 1992).

Process training addresses cognition. In process training, focus is not on teaching a behavior but on teaching the process of understanding the social situation and using learned skills appropriate to the situation. Training usually involves the following steps: (a) decoding, (b) decision-making, (c) performance, and (d) evaluation. Individuals with mental retardation are taught to understand

the context of the social situation, determine alternative social behaviors and choose the most desirable, perform the behavior, and evaluate effectiveness of the chosen behavior (Huang & Cuvo, 1997).

The teaching of social problem solving provides a framework for interpreting the social situation and generating appropriate alternative behaviors. This approach teaches cognitive skills which may increase social competence and, in turn, job retention (Wehmeyer & Kelchner, 1994).

The purpose of this study was to determine effectiveness of a problem-solving curriculum for transition-age students with mental retardation. A modified version of the interactive videodisc problem-solving training package, S*olving Your Problems* (Browning, n.d.), was used for training. Individuals with mental retardation were taught a five-step problem solving procedure. The steps included: (a) identify the problem, (b) size up the problem, (c) think up solutions, (d) decide upon a solution, and (e) study what happens. The investigation was designed to answer the following questions:

1. Will there be a difference between treatment and control groups in problem-solving ability after treatment?
2. Will there be a difference between treatment and control groups in problem-solving knowledge after treatment?
3. Will there be a difference between treatment and control groups in ability to use a five-step process to solve problems after treatment?
4. Will there be a difference between treatment and control groups in number of solutions generated to two problem scenarios after treatment?
5. Will students in the treatment group learn to use the 5-step process to solve untrained problem situations?
6. How will participants in the treatment group rate the training curriculum after treatment?

Method

Participants and Setting

Four classes of special education students participating in an Occupational Diploma program (a diploma option for special education students with focus on employment skills) at two high schools in rural southeast Alabama participated in the study. Based on quasi-experimental group design, the intact classes were randomly assigned, two as treatment and two as control groups.

Training sessions and assessments were conducted in special education classrooms at the high schools. All members of the classes participated in the study, but only those who met the selection criteria described below were included in the study.

Participants were required to meet the following selection criteria: (a) provide a signed consent form from a parent or guardian, (b) provide student assent, (c) have a reported IQ score equal to or less than 70, and (d) complete both the pre-treatment assessment and the post-treatment assessment. Additionally, data were only used from those in the treatment group who attended 70% of the training sessions.

Thirteen participants were members of the classes assigned to the treatment group. The treatment group was 84% male and 100% non-white, with a mean age of 17 years, and a mean IQ of 51. Five of the participants were members of the classes assigned to the control group. The control group was 80% female, 40% white and 60% non-white, the mean age was 17 years, and the mean IQ was 60.

Materials

A modified version of the problem-solving training package, S*olving Your Problems* (Browning, n.d.) was used for training. The training package includes (a) an instructor's guide, (b) lesson plans, (c) videodisc vignettes of problem situations, (d) a curriculum knowledge test, (e) student curriculum questionnaire, and (f) a problem-solving workbook. A videodisc player, television, and written problem scenarios were additional materials used in the training program.

Dependent Measures

Six dependent measures were used to determine effectiveness of the intervention. The first four were given to both treatment and control groups, the last two were completed

by the treatment group only. Descriptions of the dependent measures follow.

Interpersonal Cognitive Problem-Solving (ICPS). ICPS, a sub-test of the *ARC's Self Determination Scale* (Wehmeyer & Kelchner, 1995), was the first dependent measure. This measure presents beginning and ending for six problem scenarios. Participants were asked to provide the middle for the scenario. Scenarios depict interpersonal problem situations common to students in high school. Each answer is scored on a scale of 0 to 2. There are clear examples to use in scoring and good concurrent validity with Means-End Problem Solving (Platt & Spivack, 1975).

Because the interpersonal cognitive problem solving measure required the evaluator to rate the answer, the investigator and a trained graduate student both rated the answers. In the evaluation of the ICPS, percentage of agreement was calculated using the point by point agreement method (Kazdin, 1982). In cases of disagreement, the lower of the two scores was used in the data analysis. Reported inter-rater reliability was .97.

Curriculum Knowledge Test (CKT). The CKT (Browning, n.d.) consisted of fourteen true/false and multiple-choice questions about problem solving. The assessment instrument was based on the model of problem solving used in the curriculum.

Solve the problem (STP). In this measure participants were read two problem scenarios and asked to write down the steps they would use to solve each problem (i.e., what do you do first, second, and so on). Based on the five-step problem-solving process, the score for each problem ranged from 1 to 5. Participants received one point for each of the steps correctly used to solve the problem.

The STP assessment required the evaluator to make a judgment about the number of steps used based on the written answer. To avoid bias, both the first author and a trained graduate student judged answers. In evaluation of the STP, percentage of agreement was calculated using the point-by-point agreement method (Kazdin, 1982). In cases of disagreement, the lower of the two scores was used in the data analysis. Inter-rater reliability was calculated at .95.

Brainstorming (BS). Because individuals with mental retardation have difficulty generating alternative solutions to problems (Wehmeyer & Kelchner, 1994), an important component was brainstorming solutions (step three of the problem-solving procedure). BS measured the number of solutions generated for two problem scenarios. Participants were read each scenario and asked to list as many solutions as possible. The participant's score was the number of solutions generated.

During the training phase, those in the treatment group were asked to complete three independent assignments in their workbook. These assignments occurred on Day 6, Day 8, and Day 10 of the training phase. Participants were asked to identify a problem they encountered and provide a solution using the five-step procedure. All written assignments were evaluated by the first author at the end of training to see if participants were able to generalize use of the procedure to untrained problems.

Additionally, those in the treatment group were asked to complete a Student Curriculum Questionnaire (SCQ) (Browning, n.d.). After completing the training and assessments, each of the participants were read the five questions about the training program and asked to select one of three provided responses.

Procedure

Classes were randomly assigned to one of two groups, treatment or control. Only the treatment group received training. The first author, a graduate teaching assistant, conducted all assessments and classroom training. A graduate student assisted the first author by monitoring participants, redirecting them when needed, and giving assistance with workbook assignments. Before the intervention, the first author and graduate student, both reviewed the training manual, learned the training protocol, and met for two 1-hour sessions and practiced working with the interactive videodisc program.

Pre-treatment phase. During the pre-treatment phase, all participants were asked to complete four assessments. The first was a measure of interpersonal cognitive problem-solving (students must provide the middle of a story when given the beginning and end), the second was a curriculum knowledge test, the third measured participant's ability to solve

two problem scenarios using a five-step process, and the fourth was a measure of the number of solutions generated for two problem scenarios. The first author and the graduate assistant read the directions and scenarios contained in all of the pre-treatment measures to participants. Both the first author and graduate student provided assistance with spelling and, in some cases, wrote the answer dictated by the participant.

Treatment phase. Only those in the treatment group received training. This phase began immediately following the pre-treatment phase. Training sessions lasted approximately 60 minutes per day for 10 days.

Curriculum. Those in the treatment group were taught to solve problems by using the following steps: (1) identify the problem, (2) size up the problem, (3) think up solutions, (4) decide on one solution, and (5) study what happens. Lessons were delivered primarily via an interactive videodisc program. Each training session included a review of the problem-solving procedure, opportunities for verbal rehearsal of learning points and behavioral rehearsal of the procedure as well as role-plays of solutions.

The program is divided into five lessons. Two training sessions were spent on each lesson. The focus of Lesson 1 was on why we should solve problems. Lessons 2 and 3 covered how to solve a work problem. The focus of Lesson 4 was on solving a people problem. Lesson 5 focused on solving a money problem.

The curriculum presented three people with three different problems: a work problem, a money problem, and a people problem. The first person had a problem getting to work on time, another had a problem paying back a loan, and the third had a problem dividing household chores with his roommate.

The first author led subjects through the problem-solving procedure, paying careful attention to encourage the participants to brainstorm solutions to the problem. Due to the interactive nature of the videodisc-training program, participants were able to choose a solution to the problem from the menu and see results played out before them. Built-in pauses allowed for discussion of the problem. This interaction taught participants that there are many solutions to problems and that different solutions for the problem may produce different results.

Each participant had the opportunity to lead fellow classmates through solving a problem situation. Additionally, participants tested alternate solutions in role-play situations. This behavior rehearsal and role-play allowed participants to practice the problem-solving steps as well as appropriate interaction skills (e.g., tone of voice, body language). Students were asked to solve their own problems on three occasions.

Post-treatment phase. The day following the end of treatment, both treatment and control groups were asked to take the four assessment measures again. Scores on the post-treatment measures were compared to pre-treatment levels.

Fidelity of Treatment

To insure the investigator was following the training protocol, fidelity of treatment was measured across 20% of all training sessions. Two trained observers (i.e., a graduate research assistant and a certified special education teacher) simultaneously viewed the lesson to assure that all training procedures were followed. Percentage of agreement was calculated using the point-by-point agreement method (Kazdin, 1982). In cases of disagreement, the lower of the two scores was used in the data analysis. Based on combined scores of two observers, observed fidelity of treatment was .95.

Results

A 2 X 4 mixed between/within analysis of covariance (ANCOVA) was conducted using SPSS 10.0 for Windows. The between factor was group (experimental vs. control), the within factor was problem solving ability measured by four instruments (ICPS, CKT, STP, and BS), and the covariate was IQ.

Data for 18 participants (13 experimental, 5 control) was used in the analysis. Due to small sample size alpha was set at .15 (Stevens, 1996). There were no univariate or multivariate within-cell outliers at alpha = .05. A significant between factor effect of group was reported, $F = 5.80$, $p = .029$ (see Table 1).

TABLE 1

Test of Between Subjects Effects

Source	*df*	*F*	*Sig.*	*Eta Squared*
GROUP	1	5.808	.029	.279

Based on a significant between factor effect, post-hoc ANCOVAs were conducted on each of the four outcome measures. Results are reported below and presented in Tables 2 and 3.

The first outcome measure examined was ICPS. The test of between-subjects effects (treatment vs. control) was not significant ($p = .54$).

The second outcome measure examined was CKT. In this case, the test of between-subjects effects (treatment vs. control) was not significant ($p = .165$, $\alpha = .15$). The observed power was .277, indicating only a 27.7% chance of detecting a difference if one actually existed.

STP was the third measure examined. The results of the test of between-subject effects indicated a significant difference ($p = .013$), with the treatment group scoring higher. The effect size was large (.343).

BS was the last measure examined. Results of the test of between-subjects effects indicated no significant differences between groups ($p = .225$).

Participants in the treatment group were asked to complete two additional assessments. One was a series of three workbook assignments, the other a student curriculum questionnaire. During the training phase, students in the treatment group completed three workbook assignments in which they were asked to identify and solve their own problem using the five-step process. These assignments occurred on Day 6, Day 8, and Day 10 of the training phase. Workbook answers were examined by the investigator for evidence of application of the trained problem-solving process to novel problem situations.

On the first attempt (Day 6), none of the participants was able to identify a problem. Because no one was able to identify their own problem, the investigator read a prepared novel problem situation and the participants responded in their workbook. Even though they were not able to identify their own problem, the participants were able to use the five-step process to solve the given problem.

An examination of the second assignment (Day 8) yielded results. On the second assignment, three students (23% of sample) identified and solved novel problem situations in their workbooks using the five-step process. Untrained problem situations included: (a) bus driver yells at him because he doesn't sit down on the bus, (b) his sister always wants him to go to the store and buy her gum, and (c) working with the bricks (masonry class) at trade school is too hard.

Five participants (38% of sample) solved novel problem situations in their workbooks on the third assignment (Day 10). A review of workbooks yielded the following novel problem situations: (a) an argument with a friend at lunch, (b) teacher won't let him work on his project at trade school, (c) needed money for cigarettes, (d) had a fist fight with a friend, and (e) having a problem with parents because they don't do things with him anymore like they used to.

After completing training and assessments, participants were asked to complete the SCQ. Students were read the questions and asked to choose one of three responses to indicate their opinion of the training curriculum. Participants generally responded positively to the training program. The questions and responses are presented in Table 4.

Discussion

The purpose of this study was to determine effectiveness of a problem-solving curriculum

TABLE 2

ANCOVA Summary Table

Source	*df*	*F*	*Sig.*	*Eta Squared*
ICPS	1	0.379	.547	.025
CKT	1	2.129	.165	.124
STP	1	7.846	.013*	.343
BS	1	1.602	.225	.220

* denotes significance ($\propto = .15$)

TABLE 3

Adjusted and Unadjusted Group Mean Differences for Problem-Solving Measures

	Treatment Group		*Control Group*	
Measure	*Adjusted Mean Difference*	*Unadjusted Mean Difference*	*Adjusted Mean Difference*	*Unadjusted Mean Difference*
ICPS	0.507	0.5385	−.5180	−.6000
CKT	1.952	1.9231	.1250	.2000
STP	4.921	4.923	.0057	.0000
BS	1.351	1.3846	−.5140	−.6000

for transition-age students with mental retardation. The study was designed to answer the research questions listed earlier. Each of the findings is discussed below.

Though results for the ICPS indicated no significant differences between groups after treatment, an examination of the actual mean differences indicated the treatment group did have a small gain (+.51), while the control group had a small loss (–.52) after treatment.

These results do not show as strong an increase in ability to solve problems as Castles and Glass (1996) reported when they compared a problem-solving procedure, a role play procedure and, a combination role play and a problem-solving procedure. Results of their study indicated that both the problem-solving procedure and combination procedure produced statistically significant higher scores on an investigator developed problem-solving measure than role-play alone. Castles and Glass may have found such strong results because the trained procedure was very highly correlated with the outcome measure.

The reported mean difference on the CKT was not significant ($p = .165$, $\alpha = .15$) although the treatment group increased nearly two points, while the control group gained only .2. An examination of the raw scores indicated 11 of the 13 (84.6%) participants in the treatment group scored higher after treatment, one stayed the same, and one scored lower. Not finding a significant difference between groups may be a function of low esti-

TABLE 4

Results of the Student Curriculum Questionnaire

Question	*Answer*	*% selected*
1. How much did you learn from the lessons?	nothing	0
	a few things	7.7
	a lot	92.3
2. Were the lessons easy or hard?	easy	38.5
	just right	61.5
	hard	0
3. How much did enjoy the lessons?	not at all	0
	some	15.4
	a lot	84.6
4. How much information was new to you?	nothing new	15.4
	some was new	61.5
	all new	23.1
5. Would you like some other lessons like these?	no	15.4
	maybe	23.1
	yes	61.5

mated power. However, the effect size was large (.12) suggesting the treatment had an effect even though no significant results were present.

These findings are consistent with findings of Browning and Nave (1993). In their study, Browning and Nave investigated effectiveness of the same problem-solving curriculum. These investigators found that participants with moderate mental retardation in the treatment group did score better on the post treatment curriculum measure than the control group, but did not show enough improvement to make a significant difference between groups ($p = .208$, $\alpha = .05$).

In each study, the current research and Browning and Nave (1993), the intervention was short (10 days, 5 days). Extending the training program over several weeks may allow participants to not only better acquire curriculum knowledge, but also become fluent in the curriculum, possibly making even more post-treatment gains.

Results found by Foss, Autry, and Irvin (1989) were also similar to the present study. These researchers found that participants who were trained using a combined problem-solving/video-tape modeling procedure, similar to the one used in the current study, did better on the curriculum measure than those trained using a behavior rehearsal/teacher modeling procedure.

Was there a difference in the ability to use a five-step process to solve problems between treatment and control groups after treatment? Results indicate a significant difference between groups. The treatment group performed better than the control group, clearly demonstrating that the participants learned to use the problem-solving procedure.

Hughes and Rusch (1989) found similar results as they taught two individuals with severe mental retardation a self-instruction process to solve problems on the job. In their study, process training was an effective way to increase problem solving in both trained and novel situations.

The findings of Park and Gaylord-Ross (1989) were also consistent with the present study. These investigators also taught individuals with disabilities to successfully use a problem-solving procedure to improve interactions with non-disabled co-workers.

Because individuals with mental retardation do not generate as many alternative solutions to a problem situation as their non-disabled peers (Wehmeyer & Kelchner, 1994), generation of alternative solutions was the subject of the Brainstorming measure. No significant difference was reported between groups on generation of alternative solutions, but a computation of the mean increase after training indicated the treatment group-mean increased 60%, while the control group mean decreased 28%. This indicated the training was effective in increasing the number of solutions generated.

Castles and Glass (1986) found stronger effects of treatment when they compared a social skills training approach, an interpersonal problem solving approach, a combined social skill training and problem solving approach, and no treatment, to increase the generation of alternative solutions to problem situations.

In their study, individuals with mental retardation trained with the interpersonal problem-solving approach and the combination approach generated significantly more alternative solutions than peers in the control group. Stronger results may have been due to a longer training period (seven weeks) and older participants.

Another area of interest was whether or not participants in the treatment group learned to solve novel problems as a result of training. Generalization of trained skills to novel situations has long been a concern of researchers working with individuals with mental retardation (Gumpel, 1994).

Participants of this study were given three opportunities to identify and solve their own problem. These workbook assignments were designed to promote generalization of the trained five-step problem solving process to novel real-life problems. An examination of assignments revealed that no participant was able to identify and solve a novel problem on the first assignment, 23% of the participants solved novel problems by the second attempt, and 38% of participants solved novel problems by the third attempt. This finding suggests that participants were beginning to generalize the procedure to novel situations. If training were extended, the investigator would expect this trend to continue.

O'Reilly and Chadsey-Rusch (1992) found

similar results. In their study, a problem-solving training approach to increase interaction skills led to generalization of trained skills to novel situations for all three participants with moderate mental retardation. Investigators trained for generalization by using multiple exemplars and providing opportunities for interactions in the natural environment (lunch room) with a variety of co-workers. Conversely, Castles and Glass (1986) found no generalization of the trained procedure to novel situations. These authors suggested incorporating generalization strategies into the training program.

In the current study, researchers planned for generalization by stressing application of the problem-solving procedure to any problem one might encounter. Participants worked through several novel problems as a group before attempting to generate and solve their own problem. This emphasis may have contributed to the generalization of trained skills.

An often overlooked aspect of a training program for students with mental retardation is an affective evaluation of the training (Soto, Toro-Zambrana, & Belfiore, 1994). Participant reaction to training was the subject of the sixth research question. Participants were asked to complete a five-item questionnaire, expressing their opinion of the training. Results of the survey were positive as 92% reported learning "a lot" from the lessons.

Additionally, 62% of the participants rated the lessons as "just right," while 38% rated them as easy. Eighty-five percent said that "some of the content was new" or "all of the content was new," and 62% would like more lessons like these.

These findings were not surprising to the investigator as most participants actively participated in the training, many volunteering to role-play or lead the group through the problem-solving process. It is this investigator's experience that when students are motivated and excited by the training program they tend to pay closer attention, exhibit fewer inappropriate behaviors, and learn more. Therefore, student input about the training program can be very important in the development and implementation of training programs (Beirne-Smith, Patton, & Ittenbach, 1994).

Limitations. Results of this study are subject to a number of possible limitations including small number of participants in a limited geographic area and a relatively short training period. The assessments and workbook assignments were all paper and pencil tasks and many of the participants in the study had limited writing skills. Even though assistance was offered to all of the participants on written tasks, individuals with mental retardation do not always self-monitor performance and know when to ask for help (Beirne-Smith et al., 1994). The training occurred at the very end of the school year and some of the participants may have been less focused on schoolwork. For example, during one training session, many students were absent getting ready for the prom. On another occasion, training was delayed for graduation awards. Finally, training was delayed again for graduation pictures.

Recommendations for Future Research

Continued research on teaching social problem solving to individuals with mental retardation is needed. Both training programs and research studies should be more longitudinal in nature. Short-term problem-solving interventions do show promise, however, longer periods of training with application activities interwoven into the overall curriculum would allow data collection at several points in the study. Such data may better demonstrate acquisition, fluency, maintenance, and generalization of problem-solving skills and could be valuable in development of better curricula.

Additionally, more studies measuring social problem-solving ability of successfully employed individuals with mental retardation (e.g., Wehmeyer & Kelchner, 1994) need to be conducted. Such data may lend more empirical evidence for the inclusion of social problem-solving training into the curriculum for individuals with mental retardation.

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Cross-Cultural Comparison of the Concept of "Otherness" and Its Impact on Persons with Disabilities

Nikki Murdick, Paul Shore and Mary M. Chittooran
Saint Louis University

Barbara Gartin
University of Arkansas

Abstract: Throughout the world there has been concern that persons with disabilities are being perceived as "other" than us and that differences imparted by disability result in more dissimilarity than actually exists. A summary of this concept of "otherness" and disability in the United States, Eastern Europe, and India is presented.

"Does anyone know what 'normal' is?" Smart (2001) begins her discussion on disability with this pivotal question. The question reflects the perception that persons with disabilities are "different" from the rest of us (Bogdan & Knoll, 1995). Normality and who is normal have been defined in different ways according to the time and culture in which the question was asked. As Smart says:

> Disability has been present in all societies in the world throughout history. In spite of the long history and the universality of disability, almost without exception, people with disabilities have been discriminated against; with that discrimination ranging from minor embarrassment and inconvenience to relegation to a life of limited experience and reduced social opportunity and civil rights. (p. 72)

According to the U.S. Commission on Civil Rights (1983) individuals in American society may possibly harbor prejudice against people with disabilities. This prejudice may result in responses that discriminate against individuals with disabilities or those whose behaviors differ from the societal norm. This may occur even though the individual does not consciously recognize that he or she harbors a prejudice against those who are different, that is, "other" than us. Numerous studies reveal, ". . .society, instead of accommodating, frequently misconstrues, overreacts to, or ignores differences in individual mental and physical abilities" (U.S. Commission on Civil Rights, p. 17). This unconscious prejudice against persons with disabilities can result in segregation, isolation, persecution, and the consideration of the individual with a disability as a "social outcast," that is, the "other" (Clapton & Fitzgerald, 2003). Blatt (1987) provides us with a definition of the "other" as:

> People who look too different, or behave too differently, or who see the world too differently, or whose visions about life itself are not easily appreciated . . . (p. 305)

This perception of "otherness" has led to the belief that the differences imparted by the individual's disability contribute more dissimilarity than actually exists (Bogdan & Knoll, 1995; U.S. Commission on Civil Rights, 1983). This view has been identified as *disability spread* which is a "societal tendency to generalize and make broad inferences about the nature of disability" (Van der Klift & Kunc, 1994, p. 1). According to Fulcher (1989), this perception can be seen in media presentations that provide us with a graphic portrayal of societal beliefs:

> Disability is not about wheelchairs, though judging from what the media present and from the covers of books about disability, this would appear to be the predominant image. Nor is it to be understood as primarily a medical phenomenon: such a perception reflects the authority and influence of the medical professional and the extent to

Correspondence concerning this article should be addressed to Nikki Murdick, 3750 Lindell Blvd., Saint Louis University, St. Louis, MO 63108.

> which its ideas penetrate and inform everyday and professional discourses on disability. Rather, disability is a category that is central to how welfare states regulate an increasing proportion of their citizens. In this sense and context, it is a *political and social construct* used to regulate. (Fulcher, 1989, p. 210)

Fulcher (1989) discusses the concept of disability and beliefs attached to it as it pertains to development of public policy. According to her, the complexity of the concept of disability does not come from its physical or mental manifestations but from ". . . social and political use to which the construct of disability is put, independent of the presence, or intricacies, of an impairment" (Fulcher, p. 25). Thus the concept of disability and how society will respond to it depends on the beliefs and perceptions of each country, that is, society. Comparing attitudes in different countries is difficult because the terminology used in defining "disability," "handicap", and "normal" are only starting points for the understanding of the concept of disability. These terms may also vary depending on the value given to individuals with disabilities by their society. According to Smart (2001), "perceptions of disability labels, expectations of people with disabilities, and ascribed meanings of the experience of disability are all shaped by the broader culture" (p. 71). In this discussion we will briefly touch on three areas of the world and their societal responses to, and therefore perceptions of, disability.

Otherness in United States

The United States is a very diverse and pluralistic society that greatly benefits from this cultural mix. In fact you might say it is one of the best-known, and possibly defining, characteristics of the country (Gargiulo, 2003). Although it is seen as one of its greatest strengths, it also may be one of its greatest weaknesses. Perhaps nowhere else is this diversity more noticeable than in our schools.

Inclusion of students who are culturally and linguistically diverse has presented challenges for educators, particularly in the United States (Smith, 1998). When one also includes those students who have a disability, these challenges are compounded. In fact one of the leading concerns is how to meet needs of this fast growing population, especially that of "students experiencing 'double jeopardy'—that is, linguistic differences and disability" (Gargiulo, 2003, p. 88).

In the United States, a legal and philosophical movement known presently as inclusion has progressed over the past 30 years from isolated instances of educational inclusion to a more inclusive view with the goal being "true" societal membership and individual empowerment of individuals with disabilities (Salend, 2001). Based on the underlying philosophy of the United States that every person should have opportunity for an education regardless of his/her gender, race, disability (see *Brown v. Board of Education*, 1954), parents and advocates of persons with disabilities began to push for legislation that would support integration of their children with disabilities into the mainstream of society. These individuals believe that the only way one can change perceptions and beliefs is through early and continued contact in the "normal" activities of life. Through consistent activism, a landmark piece of federal legislation was enacted in 1975. This legislation, known as Public Law 94-142, the Education for All Handicapped Children's Act (now known as IDEA, the Individuals with Disabilities Education Act) provided a nationwide mandate that *all* children with disabilities, regardless of the type or severity, were to be educated with their nondisabled peers whenever possible. This mandate was known as mainstreaming in society and as placement in the least restrictive environment within the legal community.

Within the past two decades, the focus on mainstreaming has expanded to a new philosophical position known as inclusion (Friend & Bursuck, 1999). Inclusion is a belief that students with disabilities are more alike than different from their peers, and that for them to be successful, educational opportunities should begin and continue to occur as much as possible in the neighborhood school within the classroom with their age-peers (Mastropieri & Scruggs, 2000). This change in philosophy continues to evolve and has resulted in societal and legal controversy. According to Ballard (1999) this continuing controversy has been clearly described by Skrtic in 1995:

> Most schools cope with diversity by eliminating it, moving the disabled and other problematic minorities into 'special' settings or allowing them to be lost through failure, truancy and expulsion. This is because the school is designed to achieve particular goals in highly determined ways from a chosen range of students. In contrast, schools that value diversity emphasize the need to include all students in the culturally valued activities and goals of education. They organize to achieve this through collaborative problem solving, using the uncertainty of diverse demands as a challenge that engenders creativity and flexibility. (p. 169)

Even with reform movements of recent years, the view of Americans with disabilities as "different" or "other" from Americans without disabilities persists (Rowitz, 1988). In fact, some believe that even with the addition of federal aid, and with the enactment of federal legislation that this perception of otherness is continuing (Hahn, 1987; Rossides, 1990; Smart, 2001).

Otherness in Eastern Europe

In order to understand social implications of identifying another human being as the "other," we must first distinguish several ways in which the "other" has been defined, not by him or herself, but by the surrounding society (Aserlind & Browning, 1987; Bogdan & Knoll, 1995). "Otherness" may be identified as possession of unfamiliar and/or inexplicable characteristics. Societies historically have varied in the degree to which they have expected conformity in their members, and in the degree to which "otherness," if it is defined as difference from the perceived norm, might be cause for condemnation or ostracism. At the same time, differences, even if unexplained, have not always been seen as something bad. Specifically, certain forms of exceptionality, such as epilepsy, while recognized as "different," have been perceived as Divinely induced, and have granted the person with the exceptionality a special status within a community (Bickenbach, 1993). In Russia before the revolution of 1917, in some rural districts, various types of mental illness were understood to be a connection with God, and persons suffering from these conditions were regarded with respect and even awe. Yet even in these cases, the reaction of the community, while exhibiting acceptance, did not strive towards understanding. The "other" remained defined by the norms and the language of the larger society, a pattern persisting into the Soviet era (Sukhomlinsky, 1977).

However, such instances have been exceptions to a more general rule that "otherness" implies something to be feared and shunned. This attitude has been found in many settings throughout Europe and those parts of the world under the cultural dominance of Europe. We note that the fear of "otherness" is not restricted to human beings: when the first hot air balloons sailed out over the French countryside in the 1780s, these brightly colored machines were viewed with terror by peasants, who rushed forward to destroy them as soon as they touched ground. To be different was to pose a threat to the community. Peasant societies, confronted with the occasional child born with conspicuous physical deformities, might choose to abandon the child. Social scientists may debate whether such a reaction to the unknown, the inexplicable and the unnamable is genetically influenced or is primarily a learned response, but the practical consequence of this reaction is frequently hostility towards anything and anyone that may be unfamiliar (Eisenberg, 1982; Smart, 2001).

"Otherness" as a category, while it includes a notion of difference, extends beyond unfamiliarity. "Otherness" may also include characteristics that are familiar but which are rejected because of the onus placed on the society or the societal unit in which the "other" appears (Smart, 2001). In the decades following the Second World War, socialist regimes were installed in many of the war-torn countries of eastern and central Europe. Drawing upon Marxist social and historical theory, and positing the goal of a perfectable society that addressed all the needs of the people, the governments of these countries set out to create educational and social institutions that would speed the arrival of the ideal culture (Gallagher, 2001). Financial resources of these countries ranged from slender to minimal, and the practical application of the ideology put forward by the governments soon meant that such resources as were available were expended on individuals whose

performance would reflect well on the governments themselves (Friedlander, 1995; Gallagher, 1995). While in a few cases such individuals would fall within the categories that today we might call "exceptional," most individuals with exceptionalities were not beneficiaries of a program that sought to advertise the successes of the new social order. On the contrary, often such persons were viewed as an embarrassment to governmental and educational agencies, as they seemed to be evidence that these agencies had "failed" in the mission of producing a perfect society. Persons with mental disorders, low intelligence (as identified by standardized tests), physical exceptionalities, and other conditions were hidden away from the general public and not discussed. Sometimes their very existence was denied. In the generally much freer political climate that has followed the fall of the Berlin Wall in 1989, these countries have struggled to redress these injustices, but have sometimes been hampered, not merely by a scarcity of resources, but by the cumulative impact of attitudes created during the long decades when the existence of the "other" was associated with shame and denial (Holzbauer & Berven, 1996; Whitney, 1993).

In fairness to the countries mentioned above, many of the same problems continue to plague the United States. We call attention to the case of the former Warsaw Pact nations because in this instance the "other" was not imbued with any mysterious or unnamable condition as with the case of the person with epilepsy who was credited with some miraculous connection to the supernatural. Often persons in Eastern Europe were hidden away in institutions precisely because their "condition" was believed to be so familiar, so easily labeled, and yet "incurable."

The "other," therefore, may be other because we believe we cannot know her, or because we are certain that we understand who-or what—she is all too well. And she is always "other" if we deny her the right to choose her own name.

Otherness in India

The notion of "otherness" in India mirrors, in some ways, the image that is prevalent in the U.S. and Eastern Europe. The implication of unfamiliarity with, and difference or distance from, the "other" is often just as evident in India, both historically and presently, as they are in Western cultures. However, reactions against the "other" who is disabled appear to be more extreme in the Western world, than they are in India, where attitudes toward those who are disabled have ranged from reverence to embarrassment to a fatalistic acceptance of the disability, either because children with disabilities were viewed as a divine gift to parents who had been entrusted with their care or because they were viewed as divine retribution for parental wrong-doing. In any event, the responsibility of caring for children with disabilities fell to family members who lacked physical and emotional resources necessary for the task. There are numerous anecdotal accounts of Indian adults who report playing with neighborhood children in the 50's, only to find out, years later, that their playmates had a sibling who had a disability who had been hidden away and never mentioned because of the shame it would have brought to the family.

The concept of the "other" in India may be complicated by prevailing cultural influences that shape a) the development of the self in relation to the other, as well as b) the interpretation of the self in relation to the other in individualistic as opposed to collectivistic societies. From a child development perspective, learning about and being able to identify the "other" is an important prerequisite for maturity and the foundation for subsequent learning. From this point of view, the "other" is not necessarily a hostile or unfamiliar figure, simply one that is not the self or is different from the self. Identification of the "other" normally occurs within the first few months of life so that the very first "other" in a child's life is her primary caregiver, the one person who represents warmth, trust, and needs fulfilled. This image of the "other" stands in marked contrast to that in Western societies where the "other" has come to be viewed in a negative manner, particularly when it is associated with disabilities. In a country like India, where an individual's sense of self is so connected with family and where one's well-being and reputation depend on the degree of closeness to family members, survival of the self suggests that the "other" must be kept close, not at a distance.

A second perspective on "otherness" in In-

dia has to do with social interactions that occur between the self and others in individualistic as opposed to collectivistic societies. If disability is perceived as a socially and culturally constructed category (e.g., Banks & Banks, 2001) and researchers (e.g., Kalyanpur & Harry, 1999) have claimed that the social organization of a society has a significant impact on its response to disability, then it is clear that there must be cross-cultural differences with regard to societal perceptions of, and responses to, disability. Individualistic cultures like the U.S. tend to focus on needs and goals of the individual as being paramount, rely on the self to make meaning of life, and see autonomous functioning as positive. In collectivistic cultures, like those found in India and China, however, needs and goals of the individual are secondary to those of the group, the self is viewed in relation to others, and behavior that acknowledges and supports goals of the collective is seen as positive. Collectivistic societies, therefore, emphasize a movement toward, and interdependence with the "other" unlike individualistic cultures that emphasize a movement away from, and an independence from, the "other." Examined from this perspective, "otherness" may actually have more positive connotations in collectivistic cultures, such as India and China, and more negative ones in individualistic cultures such as the U.S. and Eastern Europe. The concept of "otherness" in India as it relates to individuals with disabilities can best be understood within a cultural and sociopolitical context. While prevalence estimates of individuals with disabilities in India vary from a conservative 70 million to a high of 110 million (Misra, 2000), special education in India, unlike the U.S. and Eastern Europe, is still very much in its infancy. Indeed, legislation and services for children with special needs lag far behind those of the Western world. This may be due, in part, to prevailing attitudes toward disability that are compounded by problems of extreme poverty, firmly entrenched social inequalities, and a paucity of training facilities and resources. For example, India established the Universal Education for All policy in 1947 to provide a free and compulsory education to all children between the ages of 6 and 14 years of age but did not address the needs of those who were disabled. It was only as recently as 1992 that India enacted the Rehabilitation Council of India Act, designed to legislate minimum standards of education for professionals who worked with individuals with special needs. The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act of 1995 was the first comprehensive piece of legislation aimed at children with disabilities and mandated that all children with special needs under the age of 18 receive a free education, and that government and local agencies were to be held accountable for providing environments and services that facilitated the development of children with disabilities. It is significant, however, that this law was introduced twenty years after its American counterpart, P.L. 94-142. A third piece of legislation, in 1999, the National Trust for Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disabilities Act, ensured, for the first time in the country's history, education and welfare of persons with these conditions. If we accept Kalyanpur and Harry's (1999) contention that the IDEA in the U.S. is a cultural statement and that it clearly embodies American cultural values such as individual rights and choice, then it becomes easier to understand why similar legislation for persons with disabilities in India did not emerge sooner than it did.

Historically, care of individuals with disabilities in India has been left to families and most services for this population have been provided through private, charitable, or non-governmental organizations. Presently, however, special education in India is the province of the Ministry of Welfare, with assistance from the Department of Health, Labor and Employment. Although most special education today, especially for children with mental, emotional, and social impairments, still takes place in segregated settings where they are sheltered and protected rather than shunned, there are a growing number of children, primarily with physical impairments, who are integrated into regular schools (Vakil, Welton, & Khanna, 2002).

Despite recent, but relatively scarce, efforts on behalf of individuals with disabilities, there is an atmosphere of renewal and optimism in India. For example, in a move that was significant both for its sheer ambition and potential impact, the 2001 census, for the first time in Indian history, addressed disability as a cate-

gory, with proponents of this change successfully arguing that services to individuals with disabilities could only be improved once it was determined exactly how widespread the problem was. There is growing evidence that the "otherness" of individuals with disabilities in India is slowly being replaced by a "oneness" with those without disabilities. For example, in November of 2003, India will host the 6th International Abilympics, a series of competitions in vocational skills for persons with disabilities that is sponsored by professionals whose watchword is a focus on ability rather than disability, that is, on similarity to the norm instead of a difference from it. *Disability India Journal* regularly publishes articles that relate to children and adults with disabilities and is even beginning to include information on inclusion in societal and educational settings. The *Disability India Network* is a new online resource for professionals and families who work with individuals with disabilities and who would benefit from the support of others engaged in similar efforts. If the energy that has marked recent events can sustain itself, it is believed that advocacy, funding, and services for individuals with disabilities in India will continue to flourish. This in turn, will result in concomitant improvements in attitudes toward individuals with disabilities. It is only when their "otherness" is minimized and when their similarity to, rather than their difference from, the rest of us is emphasized that individuals with disabilities will be able to lead productive and fulfilled lives.

Summary

In the United States, Eastern Europe, and India there is ongoing concern that persons with disabilities continue to be characterized as "different" from the rest of society. This concern of "differentness" or "otherness" relates to the fact this perception may result in persons with disabilities being seen as aberrant or deviant and may lead to disenfranchisement, harassment, and violence (Smart, 2001).

In the U.S. and Eastern Europe, historically as well as today, societal perceptions of persons with disabilities are that individuals with disabilities are dependent and in need of protection, even in adulthood. This perception runs counter to societal values of individualism and independence dominant in this part of the world. However, in recent times philosophical changes and subsequent legislation have led to a shift toward independence "as people with disability have sought a political voice, and become politically active against social forces of disablism" (Clapton & Fitzgerald, 2003).

In India, this perception of dependence is impacted by the pervading collectivistic view of society. India and other collectivistic societies emphasize a movement toward, and interdependence with, the "other." But in India because of many problems including social inequalities and lack of fiscal resources, legislation and services for individuals with disabilities are far behind those in the United States. Because of the current lack of services, India too continues to perceive individuals with disabilities as the basic attributes of "otherness."

In much of the world, this designation of "otherness" as applied to persons with disabilities may be based on cultural and linguistic factors deriving from the segregation of individuals with disability from the rest of the population. As a result lives are put at risk as we do not know "them" and the resultant belief is that they are very different from us. Our feelings of pity, fear, and anxiety may lead us to feelings of disregard and disrespect toward those who are "other". We see "them" as a group and give to the group traits that support the assumption that the person with disabilities does not have the same needs, concerns, wants, and desires as the rest of us. This overgeneralization of disability to all aspects of the person has been described as a *negative halo effect* (Livneh, 1982). In essence, this effect represents a "widespread discounting and underrating of *all* of the abilities of the individual with the disability" (Smart, 2001, p. 90). The result is we no longer see the individual as a person like us, but as a label or a category of "otherness." The result may be a rationalization and justification of our conscious and unconscious prejudicial actions and beliefs that support the perception of "otherness."

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Similarities and Differences in Addition Strategies of Children with and without Mental Retardation

Lisa F. Huffman and
Kathryn L. Fletcher
Ball State University

Norman W. Bray
University of Alabama at Birmingham

Lisa A. Grupe
The Redmont School in the Waldorf Tradition, Birmingham

Abstract: This microgenetic study investigated similarities and differences in use and discovery of addition strategies in children with and without mild mental retardation across 24 sessions. Nine children with mild mental retardation in third through fifth grade classrooms and 14 children without mental retardation in kindergarten classrooms were tested individually over 12 weeks (two sessions per week with 12 addition problems per session) and were given no strategy instruction. Overall, children with and without mental retardation showed strategy change across session, progressing from less to more sophisticated strategies and did not differ in the range of strategies, with from one to six different strategies used in both groups. Pretests measures of conceptual understanding of number, including highest number counted to and magnitude estimation problems were the best predictors of accuracy during testing sessions. These results have important implications for educational practices for children with disabilities.

Much of the cognitive research conducted with children with mental retardation (MR) has focused on deficits. This research indicated deficits in many cognitive domains such as memory (Ellis, 1978), attention (Zeaman & House, 1963), and problem solving (Ferretti, 1989; Ferretti & Cavalier, 1991) that often hinder academic task performance. In contrast, recent research has shown that children with MR have cognitive competencies as well in both academic and nonacademic tasks (Baroody, 1999; Bray, Fletcher & Turner 1996). However, adopting this view in the field of special education has been slow (Baroody, 1999). Research across numerous domains to document both competencies and deficiencies is crucial to obtain a comprehensive view of capabilities of children with MR.

In the domain of mathematics (Baroody, 1999), children with mild or moderate MR have been shown to exhibit evidence of early math knowledge such as counting principles (Baroody, 1986b; Gelman, 1982; Gelman & Cohen, 1988), number concepts (Baroody & Snyder, 1983), and strategy use to solve simple addition problems (Baroody, 1986a, 1986b, 1988, 1995, 1996; Bray, Huffman, Hawk, & Ward, 1994). Research has shown that children with and without MR use a variety of observable strategies to solve addition problems (Carpenter & Moser, 1984; Goldman, Mertz, & Pellegrino, 1989; Siegler & Jenkins, 1989; Siegler & Shrager, 1984), and even spontaneously invent new strategies (Baroody, 1995, 1996). Children's addition strategies change rapidly over a relatively short period of time (Fuson, 1982; Siegler, 1987). In addition, some researchers have suggested studying children with MR because their development is often slower and may allow researchers to more clearly view change as it occurs (Baroody, 1995; 1999).

Baroody (1995, 1996) examined 30 children with mild and moderate MR across a

Correspondence concerning this article should be addressed to Lisa F. Huffman, Department of Educational Psychology, Teachers College 514, Ball State University, Muncie, IN 47306. E-mail: lhuffman@bsu.edu

large age range (6 - 20 years) over 51 experimental addition sessions during an academic year. Fifteen children also were in a control condition that did not receive sessions solving simple addition problems. Initially, researchers modeled the "concrete counting all" strategy (i.e., each addend is counted out and then the child recounts each addend to arrive at the sum) during pretest sessions when individual children failed to use a legitimate strategy to solve a problem. Across the pretest, children with mild and moderate MR readily learned the basic strategy of concrete counting all. During experimental sessions, children also spontaneously modified their strategy use to reduce number of counts needed to arrive at the sum. It is important to note that the researcher did not demonstrate these strategies, but instead children discovered them. Discovery of these modified strategies was only observed in the experimental group that had multiple sessions solving simple addition problems.

Other studies have noted that young typical children also modify their strategy use over multiple sessions involving solving simple addition problems. Siegler and Jenkins' (1989) and others (Bray, et al., 1994) examined young children's addition strategies using a microgenetic method (a longitudinal study in which children are intensively observed over an extended period of time followed by a trial-by-trial analysis of what occurred when the child solved the addition problem). In general, these studies also reported that many children without any training discovered a variety of new strategies. Similar to findings of Baroody (1995, 1996), the new strategies economize the number of counts needed to arrive at the sum. Thus, both children with and without MR appear to discover and use sophisticated strategies to solve addition problems. However, there have been no direct comparisons between children with and without MR in the discovery and use of these sophisticated addition strategies.

The present study compared the use and change of strategies to solve simple addition problems, with no training, in children with and without MR. The following questions were addressed: Do children with and without MR 1) achieve the same level of accuracy when solving simple addition problems? 2) use the same types of strategies, and with the same frequency to solve simple addition problems? 3) show the same change in strategy use? 4) have the same relationship between initial number knowledge (magnitude estimation or highest number counted) and accuracy in subsequent sessions?

Method

Participants

Participants were 10 children with mild MR (M = 8.9 years; SD = 5.9) and 14 children without MR from kindergarten classrooms (M = 6.4 years; SD = 3.7). One of the children with MR was excluded from data analysis because he guessed the same answer, i.e., "6", on each of 288 trials, even with the researcher prompting him to try as hard as he could. Thus, 9 children with MR were included in all data analyses. All children were ambulatory, had normal vision (corrected or uncorrected) and hearing. All children attended schools in a large metropolitan area in the southeast. The IQ scores of the children without MR were not available, but all children were in their age-appropriate grade placement. Mean IQ for children with MR was 68 (SD = 4.7). All IQ scores were provided by the school district. Based on pretests, the two groups were not different from each other with respect to addition accuracy and strategy use on single-digit addend problems.

Materials

A laptop computer generated problems, which the children viewed on a 22 cm monitor. A video camera placed to the right of the child, providing a view of the child, the table, and the computer screen recorded all sessions. A microphone was attached to the side of the monitor to record all verbalizations. Sessions lasted approximately 10 to 15 minutes each.

Pretest and subsequent testing sessions involved number-fact ("How much is 5 + 3?") problems using small addends. The testing sessions also included large addend and challenge problems. The small addend problems

consisted of all possible pairs of digits from 1 to 5 (excluding ties such as 2 + 2); the large addend problems consisted of all pairs, with the digits 1 to 5 for one addend and the digits 6 to 9 as the other. The challenge problems consisted of pairs with digits 1 to 4 as one addend and the digits 12 to 29 as the other addend.

Procedure

Pretest sessions. All potential participants were screened during four pretest sessions. Participants were told they were going to play a "sticker game" and that by answering math problems correctly they could receive stickers. Participants were told, "You can do anything you want to get the right answer. You can just say the right answer if you know it, or you can count or use your fingers or do whatever you want to do." Participants were also told they did not have to answer the same way every time as long as they tried their best.

During pretest sessions 1 and 2, small addend problems appeared on a computer screen for 2.5 seconds while the tester read the problem aloud (e.g., "How much is 3 + 5"?). All problems consisted of digits from 1 to 5 (excluding ties such as 2 + 2) called small addend problems. The length of time it took to answer each problem (latency) and how the child responded to the problem was recorded. Participants were given a colorful "sticker" after each correct response. A sticker was also given after three consecutive missed trials to keep the participants motivated and interested in the game. After each response was given, accuracy feedback was given to the participant. Participants were then asked, "How did you figure out the answer to that problem?" If the answer was scorable, the tester proceeded to the next problem. However, if the answer was ambiguous, the tester asked, "Did you already know it, did you count, or did you use another way to figure out the answer?" If the participant responded with "already knew it," the tester continued with the next problem. If the participant responded with "I counted," the tester asked how he/she counted. If the tester had observed the participant counting on his/her fingers, but the participant failed to report finger counting, the tester asked, "What were you doing with your fingers?" If the participant used another way to figure out the answer, the tester asked, "What way did you use?" After this probe the tester continued with the next problem regardless of the participant's response.

Pretest session 3 began with the "sticker game" after which followed an introduction to "Lance," a cabbage patch doll. Participants were told to pretend he was a younger kid just learning to add and were asked to explain to "Lance" a way to figure out the answer to 2 + 4. Following the first response, participants were asked to tell "Lance" another way to figure out the answer. "Lance" provided a pretest index of each child's level of strategy knowledge.

In pretest session 4, participants were told they were going to play the "sticker game" a little differently. First, participants were asked 36 magnitude estimation questions by the tester (e.g., "Which is larger 5 or 3?"). Participants earned a sticker after every four correct responses. Second, participants were asked to count as high as they could.

Responses to "Lance," magnitude estimation, and the highest number counted to were recorded during the pretest to be used as possible predictors of later performance.

Based on number of errors made and level of strategy knowledge demonstrated during the pretest, participants were selected to participate in additional sessions. All available children with mild MR who had not yet mastered addition were included in the study. Regular education kindergarten children who were comparable to children with mild MR on pretest accuracy were also selected. This was to ensure the two groups were similar before additional sessions.

Additional sessions. These sessions began approximately two weeks after completion of the pretest. All participants were tested individually in a room at their school and were given no strategy instruction. There were two sessions per week for 12 weeks with 12 addition problems per session for a total of 288 problems. Each session began with a review of instructions (identical to those used in pretest sessions 1, 2, and 3). Problems appeared on a computer screen while the tester read them aloud (e.g., "How much is 3 + 5"?). Stickers

were awarded as they had been in pretest sessions. After participants responded to each problem, probe questions identical to those in the pretest (regarding how they solved the problem) were asked.

During the first 12 sessions, children received 10 small addend problems (both addends less than or equal to 5) and two large addend problems (one addend less than or equal to 5 and one greater than 5 but less than 9). During the last 12 sessions, participants received eight small addend problems, two large addend problems and two challenge problems (one addend greater than 10, the other less than 5). The 24 sessions were divided into four blocks of six sessions each.

Data Reduction

Pretest responses to "Lance," magnitude estimation, and highest number counted to were recorded during each session.

For each addition problem presented during pretest and additional sessions a microgenetic analysis was conducted, focusing on detailed trial-by-trial analyses of videotapes. Accuracy, strategy use, answers to interview questions, and latency on each of the addition problems were scored for each participant. Categorization of strategies (Table 1) was adopted from Siegler and Jenkins (1989).

As in Siegler and Jenkins (1989), when children's strategies could be observed via videotape, strategies were scored based on observed strategy. When strategies were unobservable, strategies were scored based on the child's report of strategy use. All videotapes were scored by one of four raters. Reliability among raters was greater than .90 on all measures for both pretest and additional sessions.

Results

Do children with and without MR achieve the same level of accuracy? Overall, children with (55%) and without MR (72%) did not differ in accuracy across the additional sessions, $t(21) = 1.25$, $p = .23$. Because of this, we re-examined the pretest data. Although we were interested in a general mean comparability in pretest accuracy in the two IQ groups, we noted that the groups dichotomously broke into either low (<35% correct) or high accuracy (>85% correct) subgroups when pretest accuracy was examined. The high accuracy group consisted of nine children without MR ($M = 90\%$ correct) and four children with MR ($M = 94\%$ correct). The low accuracy group consisted of five children without mental retardation ($M = 28\%$ correct) and five children with MR ($M = 23\%$ correct). Moreover, there were no differences in pretest measures between children with and without MR, whereas each measure, with the exception of Lance 2, differed significantly between the two accuracy groups (Table 2). In light of this finding, further analyses considered low and high pretest accuracy group as well as intelligence group.

TABLE 1.

Types of addition strategies (adapted from Siegler & Jenkins, 1989).

Strategy	*Typical Use of Strategy to Solve "3 + 5"*
Sum	Put up 3 fingers, count "1,2,3". Put up 5 fingers, count "1,2,3,4,5". Begin counting again at 1, "1,2,3,4,5,6,7,8".
Shortcut Sum	Count "1,2,3,4,5,6,7,8", perhaps while putting up one finger for each count.
Count from first addend	Say "3,4,5,6,7,8" or "4,5,6,7,8", perhaps while putting up one finger for each count.
Min	Count from larger addend by saying, "5,6,7,8" or "6,7,8", perhaps while putting up one finger for each count.
Finger Recognition	Put up 3 fingers, put up 5 fingers, say "8" without counting.
Retrieval	Say an answer and explain it by saying, "I just knew it".

TABLE 2

Pretest Measure Results for Children With and Without Mental Retardation and for High/Low Pretest Accuracy Groups

	Children with Mental Retardation		*Children without Mental Retardation*			
	M	*(SD)*	*M*	*(SD)*	*t*	*p*
Pretest Accuracy	.54	(.38)	.67	(.32)	.877	.39
Lance 1	6.44	(4.77)	8.46	(5.32)	.911	.37
Lance 2	7.56	(4.82)	7.15	(5.43)	−.178	.86
Highest Count	31.56	(19.24)	52.77	(26.63)	2.04	.06
Magnitude Estimation	.81	(.23)	.95	(.11)	1.95	.07
	Low Pretest Accuracy (<35% correct)		*High Pretest Accuracy (>85% correct)*			
	M	*(SD)*	*M*	*(SD)*	*t*	*p*
Pretest Accuracy	.25	(.08)	.91	(.07)	−20.93	.001
Lance 1	5.30	(5.31)	9.58	(4.14)	−2.13	.05
Lance 2	6.40	(5.68)	8.08	(4.62)	−.767	.45
Highest Count	31.22	(14.96)	53.00	(28.22)	−2.11	.05
Magnitude Estimation	.80	(.23)	.97	(.06)	−2.46	.02

Do children with and without MR use the same type of strategies and with similar frequencies? Of the six strategies observed, children with and without MR did not differ overall in types of strategies used. Children in both groups used from one to six different strategies. Children in the high pretest accuracy group used more strategies than children in the low pretest accuracy groups (see Table 3).

Frequency of strategy use for the two intelligence groups did not significantly differ from one another on four of the six strategies observed (sum, count from first, finger recognition, and retrieval). It is especially interesting that groups did not differ on use of retrieval, with this strategy used more than half the time in both intelligence groups. Children with and without MR significantly differed from each other on use of shortcut sum, $t(21) = 1.63$, $p < .05$, and min, $t(21) = -1.62$, $p < .05$. Children with MR used the min strategy more frequently than children without MR (M = 10.1% and 3.2%, respectively), whereas children without MR use the shortcut sum strategy more than children with MR (M = 33.9 and 14.1%, respectively).

The same general pattern holds even when the two intelligence groups are broken down into high and low pretest accuracy groups. In the high pretest accuracy group, children with and without MR differed significantly in frequency of using shortcut sum, $t(11) = 1.99$, $p < .05$, and min, $t(11) = -1.65$, $p < .05$, with children without MR using shortcut sum more frequently, and children with MR used the min strategy more frequently (see Table 3). In the low pretest accuracy group, children with and without MR were only significantly different in their use of the shortcut sum strategy, $t(8) = 2.40$, $p < .05$, with children without MR using shortcut sum more frequently (see Table 3).

Because retrieval was used more often than any other strategy, it merits closer analysis. Use of retrieval was similar for children with and without MR (M = 54.4% and 52.6%, respectively). Within the high pretest accuracy group, eight children without MR used retrieval more than 40% of the time, with four of those using retrieval more than 80% of the time. All four children with MR in the high pretest accuracy group used retrieval more

Table 3

Percentage of Strategy Use by Pretest Accuracy and Intelligence Group Across Trial Block

		Strategy Type					
	Trial Block	*Sum*	*Shortcut Sum*	*Count from First*	*Min*	*Finger Recognition*	*Retrieval*
Low Pretest Accuracy							
MR (n = 5)	1	0.0	29.8	0.2	0.0	0.0	40.4
	2	0.0	25.8	0.0	0.2	0.0	39.6
	3	0.0	22.0	0.4	3.4	0.0	41.0
	4	0.0	19.8	1.0	19.4	0.0	39.6
Overall Mean		0.0	24.4	0.4	5.8	0.0	40.2
NMR (n = 5)	1	0.0	68.2	0.0	0.2	0.0	31.4
	2	0.2	62.2	0.0	0.0	0.0	37.6
	3	0.0	54.6	0.0	0.0	0.0	45.4
	4	6.2	42.8	0.0	0.0	0.0	51.0
Overall Mean		1.6	56.9	0.0	0.1	0.0	41.4
High Pretest Accuracy							
MR (n = 4)	1	6.8	3.8	4.5	19.0	1.3	61.0
	2	7.3	0.5	2.3	24.0	3.0	57.5
	3	4.3	5.8	0.5	13.3	4.0	68.3
	4	4.5	5.0	0.5	1.5	0.5	87.8
Overall Mean		5.7	3.8	1.9	14.4	2.2	68.6
NMR (n = 9)	1	11.3	17.9	4.1	7.0	7.4	50.1
	2	10.0	10.7	4.1	4.1	3.6	65.3
	3	7.6	7.4	4.9	5.9	2.5	70.7
	4	7.0	7.0	4.6	7.8	3.3	69.1
Overall Mean		9.0	10.8	4.4	6.2	4.2	63.8

than 30% of the time, with two using retrieval more than 90% of the time.

Within the low pretest accuracy group, two children without MR used retrieval over 88% of the time, while the other three used it less than 20% of the time. Three of children with MR in low pretest accuracy group used retrieval more than 95% of the time, while the other two used it on less 1% of the problems.

Although frequencies significantly differed between the intelligence groups for the shortcut sum and min strategies, patterns of strategy use by children with and without MR were remarkably similar. Figure 1 shows examples of representative children with and without MR in the low and high accuracy pretest groups. There was no one particular strategy predominantly used by children with or without MR.

Do children with and without MR show the same change in strategy use over time? Strategy evolution is defined as change in strategy use over time from using less sophisticated to more sophisticated strategies. Strategies listed in Table 1 can be thought of as a progression from least to most sophisticated. Consistent with Baroody (1996), across the continuum of strategies, children's behaviors to count and recount addends diminish over time. Over the course of the study, 10 children without MR showed strategy change (71%) while four did not (29%). Of the 10 children who showed strategy change, all used counting strategies of some type, and none used retrieval only. Of these 10 children, seven children performed with high accuracy, while three performed at a low accuracy level. Four children showed no strategy change, two children used counting strategies of some type, and two children used retrieval only.

Similarly, all nine children with MR used one of the observed strategies. Over the course of the study, six children showed strategy change (61%) while three children did

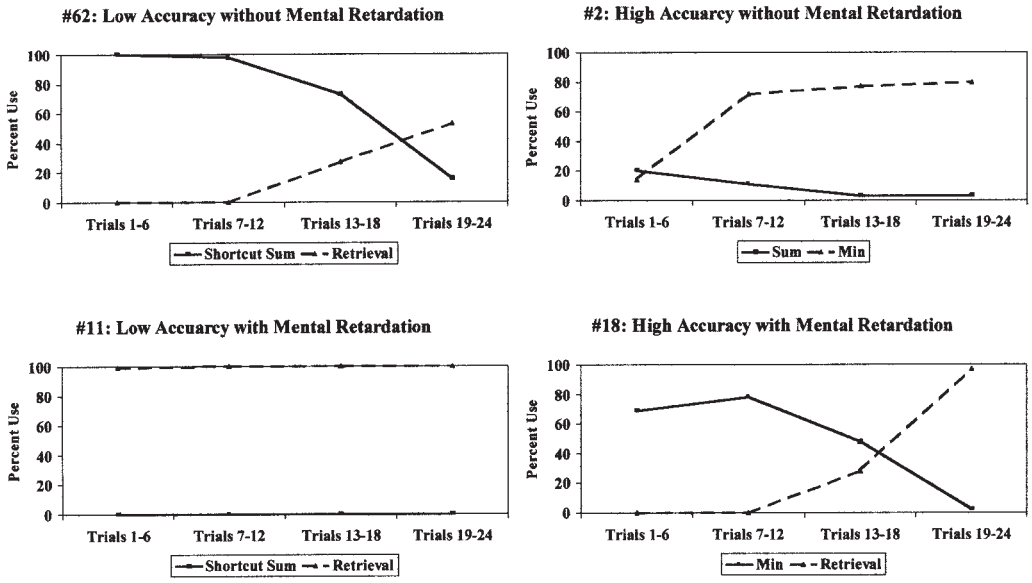

Figure 1. Examples of strategy use by children with and without mental retardation in the low and high pretest accuracy groups.

not (40%). Similar to the sample without MR, the six children showing strategy change used counting strategies of some type, and none used retrieval only. Of these six children, five performed with high accuracy, while one performed at a low accuracy level. The three children who showed no strategy change used retrieval only and performed at a low accuracy level.

Does number knowledge during pretest predict accuracy during the additional sessions? Accuracy across the study sessions was significantly correlated to conceptual understanding of number, which was based on pretest measures of highest number counted to ($r = .50$, $p < .02$) and magnitude estimation problems ($r = .54$, $p < .01$). Lance, which represented an ability to describe effective addition strategies, was not related ($r = .27$, $p = .22$). Thus more advanced conceptual number knowledge in the pretest sessions was related to higher accuracy levels in additional sessions.

Discussion

Both children with and without MR used a similar range of strategies to solve addition problems. Our analysis also revealed that children with and without MR progressed along a continuum of sophistication in their addition strategy use. Both children with and without MR used less to more sophisticated strategies over a relatively brief period of time in the absence of direct instruction. Accuracy during additional trials was predicted by measures of conceptual number knowledge during pretests. Children who demonstrated more advanced conceptual number knowledge in pretest sessions achieved higher accuracy levels regardless of classification in the additional sessions.

These findings support previous theoretical and educational implications. Theoretically, results support the notion of Baroody (1999) and Bray, et al. (1996) that children with MR have more cognitive competence than previously believed. Our direct comparison of children in these two groups indicated many more similarities across IQ group than differences. Underlying number competence in both children with and without MR is important for learning mathematics. Further, labels have not been shown to be good predictors of individual children's skills and abilities (Ba-

roody, 1986b; Baroody & Ginsberg, 1982). Even in our very restricted sample of children with MR (limited age and IQ range), we found substantial individual variability in pretest number knowledge and strategy use. This was also evident in our sample of typical children. These individual differences may be related to the wide variety of informal math experiences provided in home and preschool settings (Ginsburg, Klein, & Starkey 1998).

Children with MR are active learners (Baroody, 1999). In fact, those children who tried counting strategies and did not rely on retrieval were more likely to show strategy change. These results have implications not only for understanding the use of math addition strategies, but also for the apparently limited view of general strategy use in children with mild MR. Strategy use and change was not related to classification. Thus, limited views regarding potential academic strategy abilities of children with MR needs to be reexamined.

According to Baroody (1999), "It is essential that special educators assess the entry knowledge of children classified as mentally handicapped. Study after study indicates that special education teachers cannot take for granted that children with MR just beginning school will have the same level of mathematical knowledge that NMH children bring to school" (p. 89). Our results do suggest, however, if children with and without MR have similar levels of number knowledge and concepts, they will have similar accuracy in solving addition problems. Consequently, once basic number knowledge is learned children with MR can be expected to solve simple addition in a similar manner as typical children.

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Teaching Pointing to Numerals to Individuals with Autism Using Simultaneous Prompting

Nurgul Akmanoglu and Sema Batu
Anadolu Universitesi

Abstract: The purpose of this study was to examine effectiveness of simultaneous prompting in teaching pointing to numerals to individuals with autism. Three individuals with autism were taught pointing to numerals, which were orally named by the teacher using simultaneous prompting. A multiple probe design was used across three behaviors and replicated across three subjects. Results revealed that simultaneous prompting was effective in teaching pointing to numerals, which were named by the teacher. Subjects managed to learn the numerals and generalize this skill to 'pointing to the numerals on a calendar page'.

Functional academic skills are one of the prerequisites for individuals with autism to be a part of regular classes and community. Functional academic skills are perhaps the most useful skills for individuals with handicaps (Snell & Brown, 2000). Of course usefulness is dependent on the individuals' needs and performance in different skill areas. Learning functional academic skills facilitate students to count, read, write, shop, and perform many other skills independently.

Individuals with autism have many different characteristics. During early months of their lives, babies with autism may fail to keep eye contact with parents and other people. Also, they may fail to respond to their parents' attempts to start vocalization and play interactions. When the child with autism learns to use vocabulary and language, usually this is for requests, not for socialization. Even after language acquisition is managed, behaviors such as initiating conversations, and responding to other people's conversations are less frequent than other children (Koegel & Koegel, 1999). Therefore effective procedures to teach different skills are needed for individuals with autism.

In many studies errorless teaching strategies were used to teach different skills to individuals with autism (Farmer, Gast, Wolery, & Winterling, 1991; McCurdy, Cundari, & Lentz, 1990; McDonnell, 1987; McDonnell, & Ferguson, 1989; Schoen, Lentz, Jr., & Suppa, 1988; Wolery, Doyle, Ault, Gast, & Meyer, 1991). In these studies, most frequently used procedures are progressive time delay, decreasing prompt hierarchy, increasing prompt hierarchy and time delay. Simultaneous prompting is one of the most effective methods for teaching discrete skills (Fickel, Schuster, & Collins, 1998; Gibson, & Schuster, 1992; MacFarland-Smith, Schuster, & Stevens, 1993; Singleton, Schuster, Morse, & Collins, 1999; Wolery, Holcombe, Werts, & Cipolloni, 1993) and chained skills (Fetko, Schuster, Harley, & Collins, 1999; Parrott, Schuster, Collins, & Gassaway, 2000; Schuster, Griffen, & Ann, 1993) to individuals with moderate and severe mental retardation. However, the literature revealed no study on use of simultaneous

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prompting for teaching skills to individuals with autism.

When using simultaneous prompting, the teacher presents a controlling prompt (i.e., a prompt that ensures a correct response) simultaneously with the stimulus being taught. For example, the teacher shows a picture of a car and says, "What is this on the picture?" and immediately responds "A car." During the procedure, an independent response is not allowed by the student because the controlling prompt is always given along with the task direction. Therefore, probe sessions play a very important role for determining the transfer of stimulus control (Parrott et al., 2000).

Simultaneous prompting can be suggested for teachers and other practitioners based on several advantages. One advantage is the student does not need to be taught a waiting response. Individuals with autism usually do not have this skill (Koegel & Koegel, 1999). Another advantage is there is no need to change the teaching procedure because all trials are conducted similar to each other. The teacher does not change the time for responding, all trials are conducted with 0 s between task direction and controlling prompt. Also there is only one type of correct response for the learner; therefore, there is no need to differentiate the reinforcement procedure as in other errorless teaching strategies (Parrott et al., 2000; Tekin & Kircaali-Iftar, 2001).

Dogan and Tekin-Iftar (2002) assessed percentage of correct responses on receptively identifying occupations from picture cards. A multiple probe across subjects design study was conducted and maintenance and generalization effects were also assessed. Five occupations (e.g. teacher, butcher, grocer, etc.) were taught to each of three subjects with developmental disabilities. Simultaneous prompting procedure was found to be effective in teaching the skill and maintenance and generalization effects were positive. Griffen, Schuster, and Morse (1998) also examined effectiveness of simultaneous prompting on teaching some words that participants would encounter in their daily lives. An alternating treatments design was used. Participants were five children with moderate mental retardation between the ages of six and eleven. Results revealed that simultaneous prompting was effective on teaching target behaviors. Singleton, Schuster, and Ault (1995) also assessed effectiveness of simultaneous prompting on teaching sight words to two children with moderate mental retardation. In this study, learning by observing in the group and acquisition of nontarget behaviors were examined. Target behaviors were determined by conducting a survey of parents of the participants. Results indicated that simultaneous prompting was effective on teaching sight words to children with mental retardation, and those participants learned to read sight words via observing their friends in the group.

In another study, Wolery et al. (1993) assessed effectiveness of both simultaneous prompting and teaching feedback together for teaching naming the playing cards verbally to children with developmental disabilities. Participants were five children aged between 36 and 42 months. Results were (a) simultaneous prompting was effective for teaching naming the playing cards, (b) all five participants learned to name all playing cards in their sets, (c) after learning the first set, participants learned the second and third sets more quickly than the first set, and (d) generalization effects were positive for all materials used.

The studies summarized above were concerned with teaching discrete behaviors as in the present study. As mentioned before, there are many other studies in the literature assessing effectiveness of simultaneous prompting on chained behaviors with individuals with moderate and severe mental retardation (Fetko et al., 1999; Parrott et al., 2000; Schuster et al., 1993; Swell, Collins, Hemmeter, & Schuster, 1998).

Pointing to numerals is a prerequisite skill for students with autism for several reasons. A child who learns to point to numerals when orally named by the teacher will be more likely to use the telephone, tell time, choose the bus to take independently and so on. Furthermore, when pointing to numerals is learned, one can more efficiently learn to use money and other extended skills using numbers. Of course these are the skills to be performed in the community during daily living, on the other hand individuals who learn pointing to numerals can also use numerals while matching subjects with appropriate numerals, solv-

ing problems in math classes, etc. before using them in more comprehensive skills.

Although simultaneous prompting has been used frequently for teaching many different skills, studies on teaching individuals with autism could not be found. Therefore the purpose of this study is to assess effectiveness of simultaneous prompting for individuals with autism for teaching pointing to numerals named by the teacher. Research questions addressed are: (a) Is simultaneous prompting an effective procedure for teaching pointing to numerals (1, 2, 3, 4, 5, 6, 7, 8, 9) when named by the teacher? (b) Will students maintain acquired skills one, two, and four weeks after intervention? (c) Will students be able to generalize skills to other materials (calendar pages)? and (d) What are mothers' opinions about the importance of the study?

Method

Participants

Participants were three students with autism, two male and one female, ranging in age from 6 to 17 years old. Male students were also identified as having mental retardation. No student had any experience with systematic instruction of any skills with any of the response prompting techniques. All participants were attending special education schools. Male participants attended a private special education school, and the female participant attended a university center for children with developmental disabilities. Names of students are pseudonyms.

Participants were identified by the first author based on the following prerequisite skills: (a) keep attention on an activity for at least 10 min (during the pilot study, it was determined that sessions would last a maximum of 10 min), (b) successfully follow simple verbal instructions (i.e., show me the... give me the...), and (c) choose the named picture from three given pictures. In addition, naming numerals was a new skill not yet learned by participants.

Omer was a 17-year old boy with autism and mental retardation. He attended a private school for children with developmental disabilities for four years. He could perform basic self-help skills such as toileting, dressing and undressing independently. He had limited verbal language. He used one word sentences for requests and had ecolalia.

Baris was a 12-year old boy with autism and mental retardation. He attended the same private special education school for two years. He could manage several fine motor skills (hold a pencil, color a given shape, etc.) when told to do so and gross motor skills (kick a ball, play with group during PE classes, etc.) independently as well as self-help (toileting, eating, dressing, etc.) skills when told to do so. He could imitate mouth movements when he was told to do so. He used mimics and gestures as requests.

Serap was a six-year old girl with autism. She attended a small classroom in a university center for children with developmental disabilities for a year. She could perform all the fine and gross motor skills independently. She was also able to understand simple instructions such as "come here," "give the pencil, close the door" etc. She could use two word sentences and had ecolalia while speaking. None of the participants had experience in a mainstreamed setting.

Settings

For Omer and Baris, all sessions were conducted in a classroom in their own school. For Serap, all sessions were conducted in a classroom at the university center. All settings were segregated. In both classes there was a table and two chairs, one for the student and one for the trainer. Another table was used for the study materials. A handycam video camera was used for recording the sessions. The student and the trainer sat at the table facing each other and all the sessions were conducted in a 1:1 environment.

Materials

The controlling prompts were written on 10 cm $\times$ 15 cm cards. Cards were white and numerals were black. For generalization, daily calendar pages were used. On each calendar page, there was only one numeral. Also a 30 cm $\times$ 40 cm paste board was prepared for the numeral cards to be put on. All cards and the paste board were covered with clear stretch

film. A stopwatch was used to time session duration. The video camera was set up in the classroom before each session.

Trainer and Observer

The trainer (i.e., first author) was a research assistant in a masters program in special education. She conducted all sessions. She had three years experience teaching children with autism. The reliability observer was also a research assistant and a master's student in a special education program. She had a background in using errorless teaching procedures with individuals with developmental disabilities. The reliability observer was trained by the first author on procedures for data collection.

Procedure

Phases consisted of full probe, daily probe, training, maintenance, and generalization sessions. All sessions were conducted between 9 and 12 a.m. in participants' classes each school day. Reinforcers were placed in the classes and the trainer used them for each correct response. Also, every attempt to participate in the activities and the correct responses were rewarded verbally (i.e., "good job", "well done", etc.) by the trainer.

Full probe sessions. These were conducted before training sessions started and after criterion was met by participants in training sessions. The first full probe session was conducted in order to collect baseline data from participants. In each full probe session six trials were conducted in order to check each target stimulus (i.e., the numerals). Each teaching set contained three randomly selected numerals. Hence, in each full probe session each target stimulus was asked twice randomly. After meeting criterion with the first set, the second full probe session was conducted. Similarly, after meeting criterion with the second set, the third full probe session was conducted. Lastly, after meeting criterion with the third set, the last full probe session was conducted.

Full probe sessions were conducted in the following order: (1) Materials were placed (sets of three numerals as indicated before) on the material table in the experimental setting, (2) Numeral cards for the first teaching set were placed either on the table or on the paste board, (3) Attentional cue (i.e., "Baris, are you ready to work?") was given to the participant, (4) Task direction (i.e., "Baris, show me three") was given, (5) Participant had to respond within 4 s, (6) Correct responses were rewarded verbally and incorrect responses were ignored, and (7) The next trial was conducted after 4 s.

During full probe sessions, correct responses of participants were rewarded verbally. Correct responses were either pointing to or naming the numeral. Incorrect responses were ignored. Incorrect responses were pointing to a wrong numeral within 4 s, pointing to more then one numeral within 4 s, or not showing any of the numerals within 4 s. At the end of the full probe conditions, participants were given tangible reinforcers in order to reinforce their attention and cooperation during sessions.

Daily probe sessions. The only difference between the full probe sessions and daily probe sessions was that, during full probe sessions all target behaviors were asked, whereas during daily probe sessions only the target behavior currently taught was asked. The reason for daily probe sessions was that while using simultaneous prompting, controlling prompts were being given in each trial. Therefore, participants did not have a chance to respond independently (Tekin & Kircaali-Iftar, 2001). Hence, daily probe sessions were conducted prior to each training session in order to collect the study data. The task directions were given to participants in an unpredictable order. Daily probe sessions were conducted with two participants until they performed 100% correct responses for at least three consecutive days, and with the other participant until he performed 80% correct responses for at least three consecutive days. As in the full probe sessions, participants were rewarded verbally for each correct response during daily probe sessions and all incorrect responses were ignored. Participants' attention and cooperation were reinforced at the end of each session.

Training sessions. During training sessions, task direction and controlling prompt were delivered at the same time (0 s), which means the trainer delivered the controlling prompt just after the task direction. In each training

session, each of the target numerals was asked twice. Since there were three target numerals in each material set, six trials were conducted during the sessions. Response interval and inter-trial interval were 4 s. Controlling prompts were modeling plus verbal prompting during training sessions. Correct response was defined as to point to/give the correct numeral card after the task direction and controlling prompt were delivered. Training sessions continued until three consecutive 90-100% correct responses were given during daily probe sessions.

Training sessions were conducted as follows: (1) Three target stimuli cards were placed on the table where teaching would take place, (2) An introduction took place (i.e., "Now we are going to learn numerals with you. First I will say and you will listen. Then, when I ask you, you point to or give the numerals that I ask."), (3) An attentional cue was delivered to the student (i.e., "Baris, are you ready to work with me?"), (4) Task direction was delivered (i.e., "Serap, which one is five?" or "Serap give me/point to card three."), (5) Controlling prompt and modeling were delivered (i.e., "Look this is five." "Now you show me which one is five."), (6) Subject's response within 4 s, and (7) Correct responses within 4 s were verbally praised (i.e., "Well done", "Good job", etc.) and incorrect responses were ignored. Students' attention and cooperation behaviors were reinforced with tangible reinforcers at the end of each session.

Maintenance and generalization probe sessions. Maintenance probe sessions were conducted one, two and four weeks after training sessions were completed. Maintenance sessions were conducted the same as full probe sessions. During these sessions correct responses were praised verbally continuously and attention and cooperation behaviors of participants' were reinforced with tangible reinforcers.

Generalization probe sessions were conducted after the last full probe session took place the same as full probe sessions. Generalization was assessed across materials and calendar pages with target numerals on them were used. Pre- and post-test design was used for the generalization assessment. Pre-test was conducted just after the first full probe session and the post-test was conducted after criterion was met by each student. In each generalization session, each of the target numerals was asked twice since there were three target numerals in each material set. Six trials were conducted during the sessions. As in other probe sessions, correct responses of participants were praised verbally continuously and incorrect responses were ignored. Also, at the end of generalization sessions, attention and cooperation behaviors of participants were reinforced with tangible reinforcers.

Experimental Design

A multiple probe design across behaviors was used to examine effectiveness of simultaneous prompting in teaching pointing to numerals and replicated with three subjects with autism. Multiple probe design across behaviors is a single-subject design in which effectiveness of an independent variable is tested on three or more dependent variables (Kircaali-Iftar & Tekin, 1997; Tawney & Gast, 1984).

The dependent measure was percent of correctly pointing to the numerals named by the trainer. The numerals in each teaching set are presented in Table 1. The independent variable was the simultaneous prompting procedure. Experimental control was obtained through sequential introduction of the teaching set (Tekin & Kircaali-Iftar, 2001).

Reliability

Inter observer and procedural reliability data were collected. Sessions of reliability data collection were random video records of selected sessions were examined by the trainer and the observer independently. Reliability data were collected from 20% of all the probe, training, maintenance and generalization sessions.

Inter observer reliability was calculated by the formula of number of agreements divided

TABLE 1

Teaching Sets

1st Teaching set	*2nd Teaching set*	*3rd Teaching set*
1	2	5
9	4	6
3	7	8

by number of agreements plus disagreements multiplied by 100 (Kircaali-Iftar & Tekin, 1997). Inter observer reliability data indicated 100% agreement for all participants during all sessions.

Procedural reliability data were collected for assessing implementation of the teaching plan. Data were calculated with the formula of number of trainer behaviors observed divided by number of behaviors planned multiplied by 100 (Tekin & Kircaali-Iftar, 2001). Steps assessed were as follows: (1) controlling the materials, (2) attention securing, (3) delivering the task direction, (4) delivering the controlling prompt, (5) waiting for the response interval, (6) giving appropriate responses for the students' responses, and (7) waiting for the intertrial interval. Reliability data indicated 99% accuracy during full probe sessions, 99% accuracy during daily probe sessions, 100% accuracy during training session, 99% accuracy during maintenance sessions and 99% accuracy during generalization sessions.

Social Validity

A social validity scale was developed to collect the opinions of the participant's mother. Random sessions were chosen from video records of the sessions for mothers to watch. After watching the videos, questions in the scale were asked one by one individually by the trainer and answers were reported on the scale verbatim. The five questions were as follows: (1) Do you think it is important to teach numerals to your child? (2) What do you think are the important parts of the study I conducted with your child? (3) Are there any parts of the study that you did not like? If yes, please specify, (4) Are you satisfied with the method used to teach numerals to your child? and (5) When the study was completed, were there any positive changes in your child? If yes, please specify.

Results

Instructional Data

Results revealed that all participants met the criterion. Data indicated that simultaneous prompting was found to be effective for teaching pointing to numerals to individuals with developmental disabilities.

As shown in Figures 1, 2, and 3, all participants learned to point to numerals when asked by the trainer. Percent of correct responses of participants during full probe, training, maintenance, and generalization sessions can be seen on these figures.

Each participant's number of training sessions and trials, number of correct and incorrect responses during training sessions, and percentage of correct and incorrect responses during training sessions are listed in Table 2.

As can be seen in Table 2, total number of training sessions was 99 and total number of trials was 588. Length of all training sessions with three participants was 125 min and 50 s. Number of correct responses during training sessions was 360 and number of incorrect responses during training sessions was 269.

Maintenance and Generalization Data

Maintenance data were collected one, two and four weeks after completing training with simultaneous prompting. As can be seen in Figures 1, 2, and 3, participants maintained the skills they acquired during training sessions. Baris maintained the behaviors taught 94.6% (range = 89-100%), Omer maintained the behavior taught 85.7% (range = 84-100%) and Serap maintained the behavior taught 100%.

Generalization data were collected across materials. Calendar pages with numerals were used for generalization. During pre-test, Baris responded with 11% accuracy, Omer responded with 17% accuracy, and Serap responded with 0% accuracy. After the training sessions, Baris responded with 100% accuracy, and Omer and Serap responded with 89% accuracy.

Social Validity

Social validity findings were as follows: (a) Mothers of participants indicated that teaching numerals to their children was very important for the future, (b) As a feature of many children with autism, participants used to refuse to work with different teachers, therefore mothers were also happy about their children's working with the trainer, (c) Two

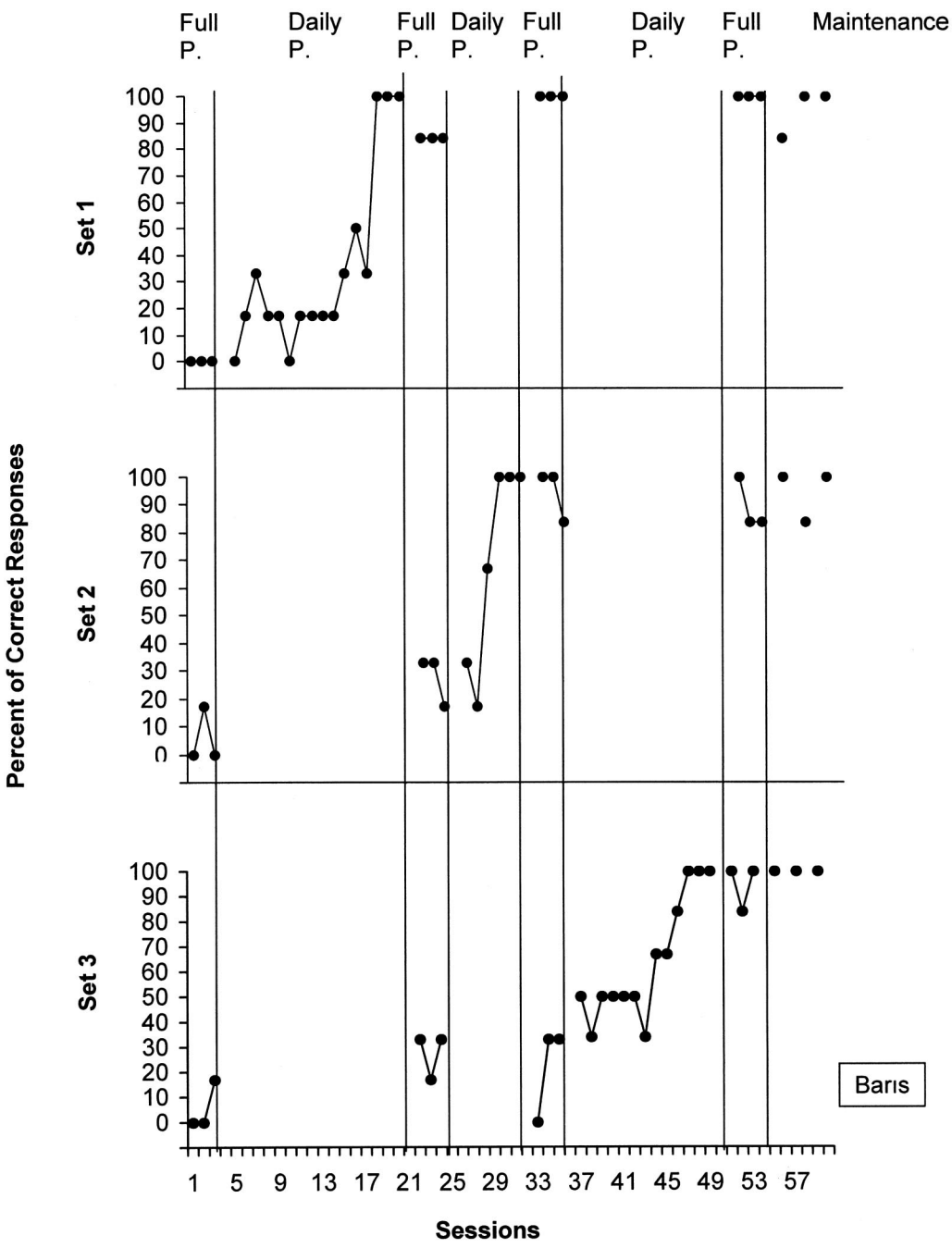

Figure 1. Percent of correct responses for Baris during full probe, daily probe, and maintenance probe sessions.

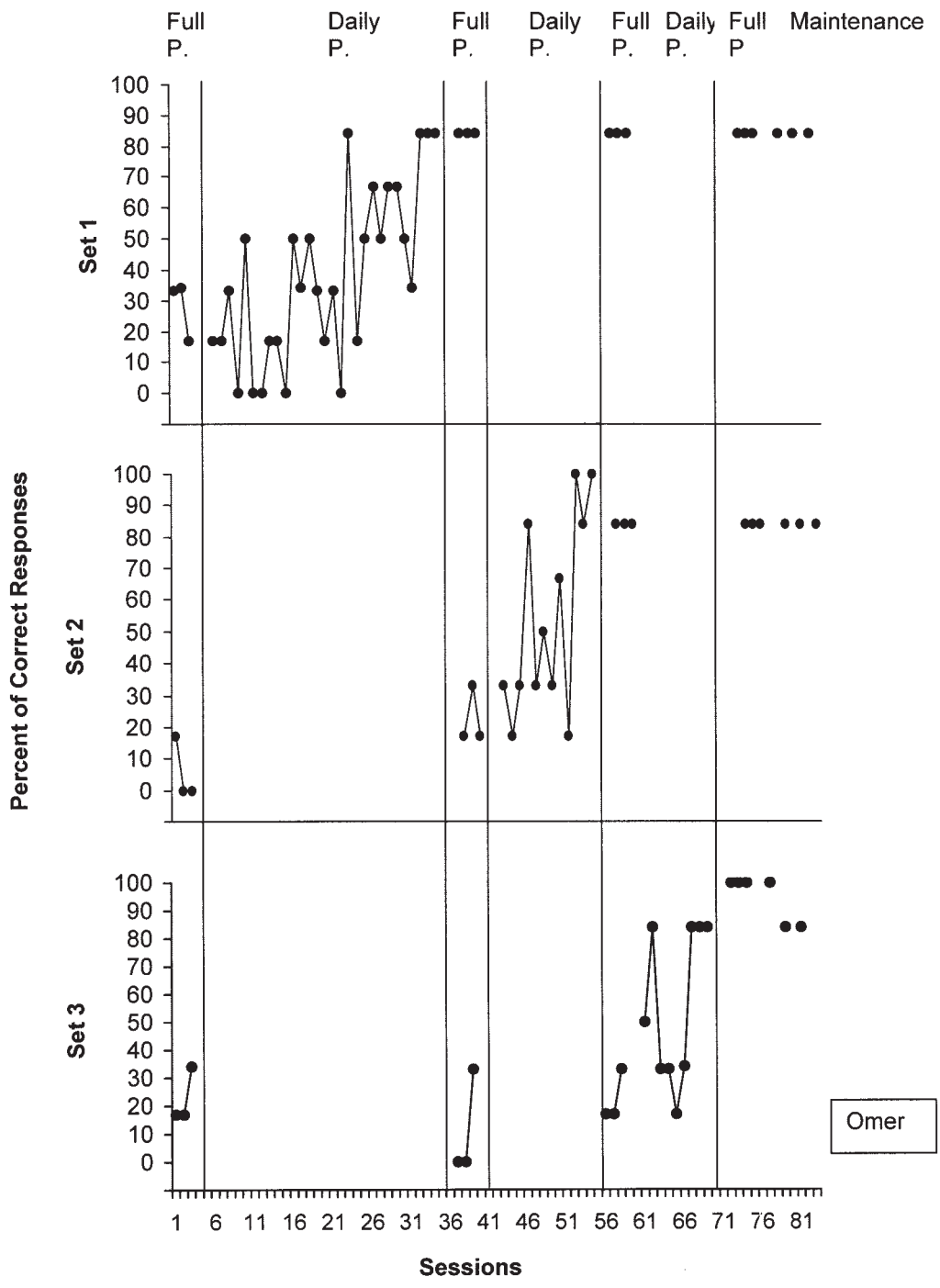

Figure 2. Percent of correct responses for Omer during full probe, daily probe, and maintenance probe sessions.

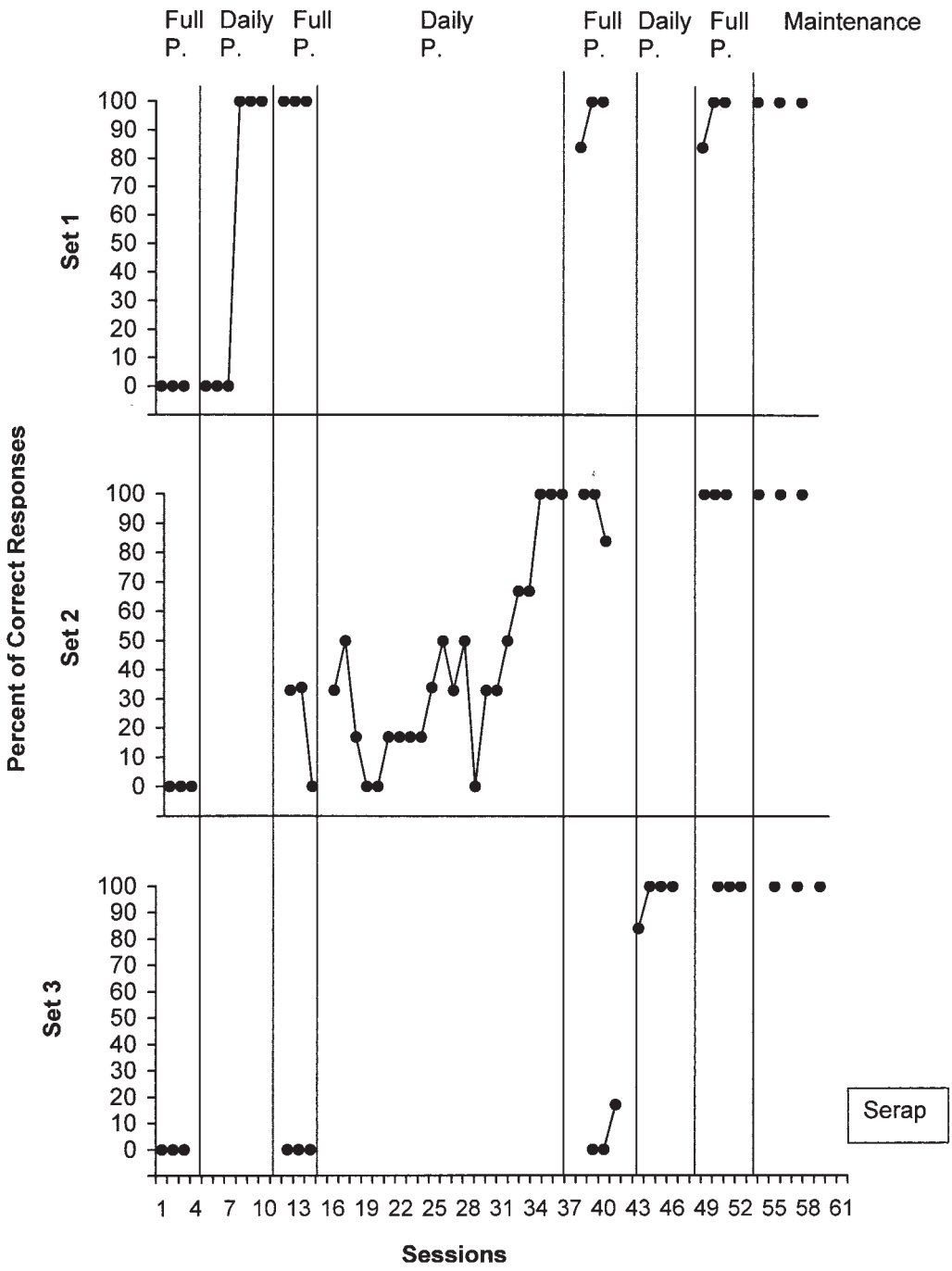

Figure 3. Percent of correct responses for Serap during full probe, daily probe, and maintenance probe sessions.

TABLE 2

Participants' Instructional Data Through Criterion

Name	*Training time (min:s)*	*Number of training sessions*	*Number of training trials*	*Correct res. during training*	*Incorrect res. during training*	*% of incorrect responses*
Baris	35:34	29	174	117	104	34
Omer	52:38	43	258	188	64	67
Serap	36:78	27	156	55	101	64
Total	125:30	99	588	360	269	165

mothers indicated that attention period of their child increased, and (d) One mother reported that her child developed imitating skills via this study.

Discussion

Results revealed that simultaneous prompting was effective in teaching pointing to numerals by children with autism. Maintenance data showed that participants maintained the skills taught and generalization data showed that participants were able to generalize the skills they learned across another set of materials (calendar pages). According to the effectiveness, maintenance and generalization data, findings were consistent with many other studies examining effectiveness of simultaneous prompting on discrete behaviors (Dogan & Tekin-Iftar, 2002; Gibson & Schuster, 1992; Griffen et al., 1998; MacFarland-Smith et al., 1993; Schuster, Griffen, & Wolery, 1992; Singleton et al., 1995).

Ease of implementation of simultaneous prompting by the trainers is another finding that shares consistency with other studies in the literature (Griffen et al., 1998; Parrott et al., 2000; Schuster & Griffen, 1993; Schuster et al., 1992). As mentioned in previous studies, simultaneous prompting again was an easy method to use by trainers for two reasons. First, the same prompting strategy is used during the whole study. Second, there is no need for the trainer to teach waiting response to participants.

Data for full probe sessions showed an increase in correct responses of participants. The trainer provided reinforcement to participants both during full and daily probe and also during training sessions in order to confirm that learning occurred only as a result of the independent variable.

Results of the present study lead to a number of suggestions for future research. First, simultaneous prompting can be used with individuals with autism to teach both discrete and chained behaviors. Second, types of errors occurring during the study can be examined. Third, effectiveness of various errorless teaching techniques can be compared for individuals with autism.

In the present study generalization data were collected across one set of materials (i.e. calendar pages). The use of other materials such as numerals on a clock, numerals on a book, etc., collecting the data within different settings ideally in less restrictive environments could be suggested and also generalization across implementers could be suggested for the future studies.

Results should also be considered in light of some limitations. The trainer met participants just before the research started. This unfamiliarity might have been a cause of the extended training time. Another limitation was that the types of errors that occurred during the study were not examined. Therefore, an error correction procedure was not conducted during this study. Even with the limitations noted, the experimental design of the study allows attribution of effect of the independent variable. Thus simultaneous prompting was found to be effective in teaching pointing to numerals to individuals with autism, a finding not previously reported in the literature.

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Learning Set Instruction in Seriation and the Oddity Principle for a Child With Severe Mental Disabilities

Robert Pasnak, Elise M. Maccubbin, Jessica L. Campbell, and Marinka Gadzichowski
George Mason University

Abstract: In a multiple baseline design, a teenager with a mental age of four years was taught two abstractions. One was the oddity principle (selecting the one object in a group which differs from the rest). The other was seriation (aligning objects along a continuum of size, and inserting new objects into their proper places in the alignments). These abilities demarcate the transition between preoperational and concrete operational thought, and are the earliest forms of purely relational responding. Learning sets of 80 oddity problems and 65 seriation problems were used to promote generalization. A "fade-out" procedure was used to make mastery of the problems as easy as possible. Combination of these techniques produced the first recorded success in teaching either the oddity principle or seriation to a child with severe disabilities, and may substantially reduce difficulty of helping many such children learn concepts at this level of abstraction.

Individuals who have mild mental disabilities become able to function at the concrete operational level of abstraction, with or without special instruction (McCormick, Campbell, Pasnak, & Perry, 1990). However, Inhelder's (1968) research indicated that individuals who had severe disabilities did not develop any concrete operations. To date, there have been no published instances of individuals who have severe mental disabilities mastering even the earliest concrete operations – seriation through insertions into series, and classifying according to the oddity principle.

These are forms of seriation and classification that are especially important. They depend on understanding the relations between objects, and are the first such understandings that are not tied to absolute qualities of the objects. Hence, they are the earliest forms of concrete operations – abstractions of relations between concrete objects – that children develop.

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Individuals who have mental disabilities usually progress through the hierarchy of mental development that Piaget proposed in the same order as individuals without disabilities (Weisz, 1976; Weisz & Yeates, 1981; Weisz & Zigler, 1979). If there are no special interventions, their developmental ceilings vary with the extent of any disability. Individuals with similar mental ages usually function at similar stages in the Piagetian hierarchy whether they do or do not have disabilities.

There have been only a few tests of whether Piagetian constructs can be taught to children who have mental disabilities, and all concerned children who had mild or moderate mental disabilities. Children described as "trainable" were taught the oddity principle (Klein & Safford, 1977, 1978). Children in self-contained elementary school classrooms were taught the oddity principle and to build a series and insert objects into it (Pasnak, Campbell, Perry, & McCormick, 1989; Perry, Pasnak, & Holt, 1992). Children with mild disabilities were taught conservation of number (Kern, 1983) and substance (Richards & Stone, 1970). There are no published attempts to teach such early concrete operations to children who have severe mental disabilities. The present project was an effort to teach a boy with severe mental disability the

oddity principle, to seriate objects according to size, and to insert objects into a series.

Use of the oddity principle is a form of classification that develops after hierarchical classification and precedes class inclusion. Oddity problems can only be solved on the basis of relations between the objects a child is considering. For example, if three beads are cubes and one is round, the round bead is "odd." Conversely, if three beads are round and one a cube, the cube is odd. The relation might instead be in size (three large and one small, or vice versa), color, orientation, type, or any other dimension.

The key advance in thinking that the child has made is to recognize that the relation between the objects, rather than some absolute quality, is crucial. This understanding ordinarily develops at age four or five. A year earlier, the same child would have very persistently tried to solve such problems by learning the "right" shape, size, color, etc. in an absolute sense – always picking a round bead, or a large object, or a red one, or one having some other absolute quality, regardless of the nature of others in the set. It is exceedingly difficult to teach young (preoperational) children to respond to the relations involved in oddity, although the learning set method yields some progress (Ciancio, Rojas, McMahon, & Pasnak, 1991; Garrett, Busby, & Pasnak, 1990).

"Seriation" is a general term that means understanding the positions of objects along a continuum. This understanding is a key aspect of early cognitive development. It develops gradually, and by the time they are four years of age children have ordinarily learned to align objects from least to greatest along one continuum. This is typically accomplished by the "method of extremum" (Inhelder & Piaget, 1964/1959). All or nearly all children teach themselves to select the smallest object in a group, place it to start their series, then select the smallest object remaining in the group, place it next in the series, then select the smallest object remaining in the group, place it next in the series, then continue with this approach until all objects have been placed. If they are careful they can build quite a long series in this way. However, they do not have the understanding of the relations between objects higher and lower in the series that they appear to have. If given a new intermediate-size object to place in the series, they place it at the end instead of where it belongs in the interior of the series. If the error is pointed out, they may place the object at the other end, but are simply unable to find the place for it in the interior of the series. Leiser and Gillieron (1990) and Southard and Pasnak (1997) described the intermediate approaches children develop as they progress towards being able to insert an object into an existing series. Developing the ability to insert an object into a series requires another year or so, and represents a substantial cognitive advance over forming a series per se. It was defined at various times (Inhelder & Piaget, 1964/1959; Piaget & Inhelder, 1974/1941; Piaget & Szeminska, 1952/1941) as one of the earliest concrete operations, because it involves understanding the relations between neighboring objects in a series. Research by McCormick et al. (1990) with children who had mild mental disabilities showed that only the oddity principle precedes insertions into series in the development of concrete operations. Although McCormick et al. (1990), Perry, et al. (1992), and Pasnak et al. (1989) were generally successful in teaching this form of seriation to children who had mild or moderate mental disabilities, they had some failures with the lowest functioning children in self-contained special education classrooms. There has to date been no evidence that children who have a severe mental disability develop this form of seriation unaided, and no examples of it being taught to such children.

Nearly all teaching, whether children have or do not have disabilities, involves aiding them to apply the thinking abilities they already possess to new types of problems, situations or contexts. This is the central idea of "readiness," or the "zone of proximal development." Simple trial and error may work well, and skillful shaping or a variety of verbal techniques are very likely to succeed. However, teaching anyone to think at a higher level of abstraction than that person currently possesses, that is, beyond his "zone of potential development," is extraordinarily difficult, (or according to Piaget, impossible). Special methods are essential to produce significant progress.

The basic thesis of this research is that early

forms of concrete operational thinking could be taught to children with severe disabilities by combining methods borrowed from comparative and educational psychology. One is the learning set approach (Gagne, 1968; Harlow, 1949). This method relies on representing the same abstract principle concretely in scores of problems that require active choices by the learner. Initial learning usually requires a great deal of shaping, is very slow, and seems to consist mainly of learning by rote the correct choice for each problem. However, as problem after problem embodying the same principle is mastered, error-producing tendencies are extinguished, supporting abilities are strengthened, and through induction the principle that governs successful choices is acquired. Stimulus independence develops as the principle becomes an abstraction not tied to the absolute qualities of the exemplars used in any particular problems. If there are enough problems in the learning set, and they are variable enough in appearance and details, the learner becomes able to recognize and apply that principle immediately to any new problem.

The slow initial learning and frustration inherent in a learning set might be reduced by the fade out procedure used in errorless instruction. The fade-out procedure starts by making the correct choice obvious to the learner by providing extensive extra cueing. Initially, extra cues should be so sufficient that NO learning is required to make a correct choice. Teachers proceed by very gradually reducing extra cues, but are careful never to reduce them so much that correct choices are disrupted. If extra cue reduction is gradual and skillful enough, the learner solves the problem with fewer and fewer extra cues, until solutions are obtained for the problems that were desired all along. In this way, the learner eventually solves the problem without (theoretically) ever making an error, except through sheer inattention, even though the problem was far too difficult to be solved if presented without the fade-out procedure. The fade-out procedure is often combined with a fade-in procedure. Together, they are usually called "errorless learning," and have been used with individuals who have various disabilities, including profound or severe mental disabilities (Day, 1987; Duffy & Wishart, 1987; Touchette & Howard, 1984).

In isolation, errorless learning techniques have not been a panacea (Ager, 1994; Duffy & Wishart, 1994; Jones & Eayers, 1992). Likewise, in isolation, learning sets have not been successful with every child (McCormick et al., 1990). However, both have also had successes (see above, and also Duffy & Wishart, 1987). The combination of a fade-out technique with the shaping and trial and error learning to learn inherent in learning sets might well be more powerful than any one technique. Since the fade-out procedure can readily be combined with the learning set approach, both were used to teach early concrete operations (abstractions or relational responses), rather than simple discriminations, to a boy who had a severe disability.

Method

Participant

The participant was a 14-year-old boy of Chilean extraction with severe mental disabilities due to Down syndrome. He attended a special center for children with severe or profound mental disabilities. His understanding of both Spanish and English was very limited, and he did not perform well enough on the Wechsler Primary and Preschool Scale of Intelligence (administered in Spanish, his best language) to permit calculation of a mental age. An estimate of approximately 3 years, 11 months was derived from the Diagnostic Ability Scales (DAS). His DAS scores were below 2 years 7 months on verbal measures but averaged 4 years 4 months on other scales. He was treated according to ethical guidelines of the American Psychological Association (1992), and his active assent was always sought. He enjoyed the procedure and always wanted to participate. He was affable, docile, and showed high mastery motivation in the experimental situation. His classroom teacher confirmed that he also showed these characteristics in the classroom. Readers who work with individuals who have severe disabilities will recognize the importance of these qualities to the success of any teaching effort.

Materials

Tests and instructional materials consisted of oddity and seriation problems constituted from many types of everyday objects. These included household, hardware, toy store, and grocery items ranging from beads and beans to screws and washers.

Oddity test. The oddity test consisted of five practice problems and 35 problems, each employing four objects. For eight oddity by type problems, three objects belonged to the same class and one to a different class, for example, three kinds of safety pins and a paper clip, or three different metal buttons and a coin. Eight shape oddity problems had three identical objects and one that differed only in shape, for example, three straight braces and a curved one, or three identical Barbie sandals and a Barbie high-heeled shoe. There were 12 size oddity problems that each had four objects that were identical in shape but one was either larger or smaller, for alternate problems. For example, there were three large Lego's and a small one, three small Lego's and a large one, three large butterflies and a small one, three small butterflies and a large one, etc. Finally, there were nine orientation oddity problems. Each of these had four identical objects. For the first three problems, three objects were presented right side up and the other upside down, or vice versa. For the next three problems, three objects slanted from 10 o'clock to 4 o'clock, and one from 8 o'clock to 2 o'clock, or vice versa. For the last three problems, three objects were pointed left and one right, or vice versa. The boy was always asked which object was pointed in a different direction.

Seriation test. The seriation test consisted of four practice problems, each having three objects of different sizes, and 26 test problems. These problems were all composed of ordinary objects. Five test problems each had three similar objects of different sizes (e.g., three padlocks, three nested cups, etc.) that were to be arranged order from largest to smallest. These were followed by four problems that each had four objects to be arranged in size order. The next five problems also had four objects, but only three were given to the boy for his initial seriation attempt. If he seriated these three correctly, the fourth object, (an intermediate-sized one) was given to him to insert into the series. There were six more problems for which he was first asked to seriate four objects and then to put a fifth where it belonged in the interior of the series. There were also five problems for which five objects were to be seriated and a sixth inserted into the series, and a final problem, which required seriating, six objects before inserting a seventh.

Oddity learning set. The oddity learning set had 20 shape problems, 20 size problems, 20 "type" problems, and 20 orientation problems. All were composed of ordinary objects that could be found in homes, out of doors, or in retail stores, and all were different from the objects used in the test.

For each shape problem, three objects were identical in shape and one different. The objects might or might not be different in color. The last six problems were reversals; for example, problem 15 had three round-headed bolts and a hexagonal-headed one, while problem 16 had three hexagonal-headed bolts and a round-headed one.

Each size problem had four objects that might or might not be the same color. They were otherwise identical except for size. Problems having three large and one small object were alternated with problems having three small objects and one large. Different types of objects were used in each of the first 14 problems, but the last six problems were reversals (e.g., three large and one small safety pin, and then three small and one large).

Each of the "type" oddity problems had three objects that were the same type of thing and one that was of a different type or class. The objects in a given problem were the same general size and shape, and might or might not be the same color. Examples are a walnut, a hazelnut, a peanut, and a brown rock, or a toy gorilla, a toy cow, a toy kangaroo, and a toy human. The last six problems were reversals (e.g., three different plastic numbers and a plastic letter, and then three different plastic letters and a plastic number).

Orientation oddity problems each had four identical objects. The first five had three objects placed vertically and one placed horizontally, or vice versa, with these orientations varying from trial to trial. The next ten problems had three objects slanting left and one slant-

ing right, or vice versa. For the last five problems, one object faced left, while the others faced right, or vice versa.

The learning set for seriation instruction was 65 problems composed from ordinary objects. The objects in each problem were similar in shape but formed a gradated series of sizes. There were 15 problems with three objects, 20 with four objects, 15 with five objects, five with six objects, five with seven, and five with eight.

Design

Because of the length and complexity of the instruction planned, a variant of the multiple baseline design was best suited for our investigation. In its classical form, this design consists of establishing baselines for two or more behaviors, then sequentially applying the treatment or experimental manipulation to each. Behaviors must be relatively independent and improvements from the baseline should be contingent upon when each was the target of the treatment. According to Evans (1985), if each of the behaviors changes in the anticipated direction primarily after the designated treatment has been administered to it, then the treatment is credited with the behavioral change.

As Barlow and Herson (1984) point out, many variations of this design are possible. Often there is only one behavior (dependent variable) rather than two or more, but the treatment is applied to different participants or in different settings. In other cases, it may be necessary to vary the manipulation to a greater or lesser extent to fit it to behaviors that are quite independent or different. For example, some differences in instruction are necessary to affect different social behaviors (Bates, 1980). If each variation in instruction is followed by significant change in the social behavior at which it was directed rather than in the other social behaviors, effectiveness of the instruction has been demonstrated.

In our application of this design, the dependent variable behaviors were quite independent, as forming objects into a sequence is not topographically similar to selecting the odd object from a group and requires a different form of abstract thought. The instruction for these two behaviors was similar but varied enough to accommodate differences in responses required from the participant.

Hypotheses

One experimental hypothesis was that significant changes would occur in seriation but not in oddity when the boy was instructed on seriation. The second hypothesis was that significant changes would occur in oddity but not in seriation when he was instructed on oddity.

Procedure

The boy's understanding of the oddity principle and of inserting into series was initially measured with the oddity test and the seriation test. After this baseline testing a "fade-out" procedure was used 15 minutes per day, five days per week for four months, to teach him to form series and insert objects into the series. Verbal and gesture cues were combined with the fade-out procedure to shape the boy's initial efforts at forming series. In this application of the fade-out procedure, a beam of light was focused on the spot where each object was to be put in turn, to guide his decisions. The light was very gradually dimmed as he mastered the first problem of seriating three objects, until he could seriate them accurately without the spotlight.

During this and all subsequent instruction, each correct decision was rewarded with a penny. These had great intrinsic reward value for this boy. He was taught to count five pennies he had earned to get a nickel, and five nickels to get a quarter, usually earning 25 – 50 cents per session. He kept this money and when his stash grew very large his teacher allowed him to use it to purchase snacks. It seemed clear, however, that he was happy to get the money even in the weeks before he was allowed to spend it. In general he was quite enthusiastic and cooperative during his experimental sessions.

The light was used again for the second problem, and gradually dimmed as he mastered this new problem until he could seriate the new objects without the aid of the light. This fade-out procedure of returning the spotlight to full strength with each new problem, using it to indicate where he should place the objects, and very gradually dimming it as he

learned how to seriate each set of objects, until he could dispense with it, was followed for all 15 3-object problems and all 20 4-object problems.

At this point he was able to seriate the 4-object problems easily. Insertions were taught by going back to the first 4-object problem and giving him only three of the objects to seriate. The fourth, which was the second or third largest of the series, was then given to him to insert. The classic error most children make before they develop the ability to insert is to place new objects at the end or beginning of the series. However, the beam of light was used to show clearly where the object should be placed in the series, and the response of inserting it was shaped by guiding his hand manually and giving verbal directions and suggestions. When this response had been shaped, the spotlight was gradually dimmed as he became more and more adept at placing the object where it belonged in the series. When he was able to insert the object accurately, without guidance of the spotlight, the next 4-object problem was introduced. The light was returned to full strength and he was again given three objects to seriate, followed by the fourth to insert into the series with guidance of the spotlight. This fade-out procedure was continued until he could accurately insert a fourth object into a series of three for all 20 4-object problems. The same approach was used to teach him to insert a fifth object into a series of four for all 15 5-object problems, and similarly to build the series and insert an intermediate-sized object for the last 15 6-, 7-, and 8-object problems.

As is usually the case for learning sets, progress was slow in the beginning, but very rapid at the end. He did not need the aid of the spotlight for the last 15 problems, and progressed through them quickly. When, after 47 sessions, he had mastered all problems, the oddity and seriation tests were readministered.

Lack of funding caused a six-month lapse before instruction could be resumed. The oddity and seriation tests were readministered. Then a shaping procedure was used to begin instruction on the oddity principle. The four objects that constituted the first form oddity problem were placed in a line before the boy, the odd object was spotlighted, and he was helped, verbally and manually, to put his finger on it. He was rewarded with a penny, the objects were withdrawn, and then the objects were presented to him again with the positions of all objects changed. When his response to this task had been shaped, the spotlight was gradually dimmed until he could select the odd object without it. This procedure was repeated for each of 20 form oddity problems, then for 20 size oddity problems, then for 20 oddity by "type" problems.

Next, instruction on orientation oddity problems began by presenting the odd object in a horizontal orientation while the others were vertical, or vice versa. This is the type of orientation problem that children typically find the easiest. As always, the spotlight was used to guide correct decisions, and gradually dimmed until unneeded. When the boy had solved all 20 orientation problems with objects in vertical and horizontal positions, the problems were presented again with three objects slanted to the left and one to the right, or vice versa. When these had been mastered, the 20 orientation problems were presented again with three objects pointed left and one right, or vice versa. This kind of orientation problem is the hardest for children to master. When all of these problems could be solved without the aid of the spotlight, the oddity and seriation tests were readministered.

Results

The baseline (pretest) seriation score was 11.5%. Immediately after the seriation instruction his score was 69.2%. The improvement was significant, $z = 2.58$, $p < .01$. His oddity baseline score was 38.8%. He scored 58.3% on the oddity test immediately after the seriation instruction was completed. The difference between pretest and posttest was not significant, $z = 1.73$, $p > .05$. Thus, during the period he was taught seriation, he improved significantly on seriation but not on oddity.

His seriation score after the lapse of six months was stable at 73.1 %, still significantly better than the baseline ($z = 3.10$, $p < .01$), and his oddity score was also stable at 52.7%. Neither score was significantly different from those made immediately after the seriation instruction, $z = 0.25$, $p > .05$ for seriation and $z = 0.52$, $p > .05$, for oddity, respectively. At

the conclusion of the instruction on oddity his seriation score was again 73.1%. His errors on oddity problems were halved, so that his oddity score increased to 77.8 % ($z = 2.00$, $p < .05$). Thus, during the period in which he was taught oddity, his seriation score remained stable but his oddity score improved significantly.

Discussion

There are many things, including familiarity with research personnel, apparatus, and tests, positive expectations, measurement change, regression, maturation, and other artifacts that can produce improvement from test to test. We suspect, for example, that this child already had some initial understanding of oddity (a chance score would be 25%), and that familiarity increased his score a little on both the oddity and seriation tests after working with the researchers for six months on seriation. The logic of the multiple baseline design is that such artifacts would produce significant gains on both dependent variables, not just the variable a child was taught. Evidence that the instruction per se had an effect is (1) the significant gain in seriation when seriation was taught, (2) the significant gain in oddity when oddity was taught, and (3) the absence of a significant gain in either construct when that construct was not taught. Apart from the difference in statistical outcomes, this child's improvement on seriation after seriation instruction was *three times* the magnitude of his improvement on oddity. In contrast, after oddity instruction his seriation scores were unchanged while he reduced his errors on oddity problems by half. It is evident that the specialized techniques employed substantially improved his mastery of whatever relation was taught, above and beyond any gains due to extraneous factors. The pattern of his oddity scores before and after the seriation instruction shows, in contrast, effects of familiarity and other situational variables per se.

Pasnak et al. (1989) showed that the learning set employed here was by itself sufficient to teach seriation to children with mild or moderate disabilities, but was not sufficient for those who functioned at a lower level. Use of the fade-out procedure was probably crucial in the present research, which involved a boy whose functioning was at an even lower level. Variations on this approach can probably be used profitably to make many problems that involve discrimination much easier for children who have disabilities. Using a variable intensity spotlight in the present research was a matter of convenience. Many other techniques can be used to make a choice completely obvious and then progressively less so; the only limitation is the ingenuity of the teacher.

The fade-out technique as applied here is not far removed from ordinary scaffolding. It differs in principle only by (1) the initial step of making the child's active choice one that is completely obvious to that child, and (2) insistence on approaching the final discrimination desired so gradually that the learner never makes any errors. In practice, a teacher's impatience or over-optimism usually results in too rapid elimination of the faded cues and some errors occur, but in theory there need be none. In any event, the children experience consistent success, and eventually master problems that would otherwise be far over their heads. In Vygotsky's terms, assisting a child to reach beyond his or her current capability is a way of stretching the zone of proximal development to reach beyond the putative level of potential development.

The fade-out method is part of a complex of procedures often called "errorless learning." Errorless learning procedures have not always proven to be the most successful approach or even to be successful (Ager, 1994; Duffy & Wishart, 1994; Jones & Eayers, 1992). Part of the problem is that, as Ager (p. 156) pointed out, a variety of procedures that have quite different operational definitions are all lumped together under the term "errorless learning." These include fading out an enhancement of the discriminative stimulus, as was done here, fading *in* a comparison stimulus, as Terrace (1963) originally did, verbal prompting, manipulating a learner's hands, and other procedures designed to eliminate errors. Success of any teaching method depends on how well the method is suited to the behavior that is ultimately desired. The fade-out procedure with a spotlight was a good fit for the discrimination tasks that were to be mastered here. The boy gradually developed

good insight into it, and when a problem was well mastered he sometimes spontaneously took the spotlight and pointed it at the correct place or object, playing the role of teacher. It is difficult to see how a fade-out procedure involving a spotlight would be as successful in teaching something like brushing teeth or donning sweaters.

Shaping is a powerful tool, and should not be neglected in guiding a child's initial responses, or responses to increases in task demands. It was important in this research for helping the child to understand what was wanted from him when he was first tested on seriation and on oddity, when seriation instruction began, when insertions were introduced, and when instruction on oddity began. Shaping and the fade-out procedure are a bit similar in purpose and execution, and are not at all incompatible. Both are methods of gradually leading the learner to the desired behavior(s) and require intuition and artistry on the part of the teacher. When failures occur, it may be because the method used was not used skillfully.

Even though such procedures can make mastery of a problem easy, the scores of problems of a learning set must be mastered, rather than just a dozen or so problems, in order to result in generalization of what was learned, especially generalization of an abstract principle. For educators, the issue with children who have severe mental disabilities is always to devise teaching methods that make better use of the intelligence the child has while evading any disruptive behaviors the child may display when experiencing frustration in learning situations. Shaping, the fade-out technique, and the learning set approach appear to be methods that can be combined effectively towards these ends, and should be part of any instructor's armory.

Comparable gains on any concrete operation have never before been demonstrated for children who have severe mental disabilities. The question for developmental psychologists is why children should be taught any such thinking ability, when there are many useful things that might be taught. One answer is that mastery of any concrete operation helps a person understand many disparate events in the world around him or her. To understand the place of items on a continuum like size, and to be aware of where new items should go in a series, is to have a key tool for understanding the immediate environment. This child developed a substantially increased awareness of such relationships, which he understood even when presented with novel objects. That his newfound seriation ability did not diminish over the many months that elapsed between the instruction and the follow-up tests suggest that this ability was reinforced by his everyday experience, as is normally the case for children. This may be an advantage inherent in teaching natural thinking processes, which are more likely to be used routinely by the developing child than many other things which might be taught. The same advantage maybe inherent in coming to understand ways in which objects can be related via the oddity principle. This seems to be the first pure abstraction that children normally develop, and once grasped it may be reinforced continually by their interaction with their environment. There is the possibility that a fundamental cognitive ability like understanding such relations between objects or understanding relations within series might prove to be foundations for more advanced cognitive abilities. Can children who are helped to learn oddity and insertions into series be helped to learn more advanced concrete operations? Such issues await exploration.

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Pica: A Review of Recent Assessment and Treatment Procedures

Stacy L. Carter
Mississippi State University

John J. Wheeler
Tennessee Technological University

Michael R. Mayton
Western Kentucky University

Abstract: The phenomenon of pica has been described within the literature in many ways, from a socially acceptable practice to a life threatening behavior. Recent prevalence rates of pica indicate relatively low occurrence of this phenomenon that makes it difficult to easily identify trends in practices related to pica. Recent literature on pica (1990 to 2002) indicate a trend toward use of more reinforcement based procedures and less use of more intrusive procedures such as overcorrection, time-out and restraint as was reported in the literature prior to 1990. Most recent studies of pica appear to have an underlying basis in behavior analysis procedures for both assessment and intervention. It appears that recent literature indicates a trend toward frequent use of functional assessment procedures to identify the specific reinforcement involved with pica. This paper reviews some of the recent assessment procedures and treatments of pica based on different etiological models.

A fundamental component of life involves the ingestion of foreign substances into the body to be absorbed and used as a source of energy. Most babies are born with some ability to distinguish between tastes and recognize hunger, and, while these may be necessary skills, they may not be sufficient skills to differentiate between food and non-food items. The ability to distinguish what should be eaten and what should typically not be eaten is most likely a response class of learned behaviors that can become highly refined over time and help individuals vary distinct differentiations among potential food items. The phenomenon of pica has been described in many ways within the recent literature, from a socially acceptable practice to a life threatening behavior. Many factors have been identified as influencing eating behavior, which makes pica an interesting yet complex topic of research.

Correspondence concerning this article should be addressed to John J. Wheeler, College of Education, P.O. Box 5116, Tennessee Technological University, Cookeville, TN 38505. E-mail: jjwheeler@tntech.edu

Phenomenon

Pica has generally been defined as repeatedly eating objects with no nutritive value. The term pica has its origins in the Latin classification of the magpie, a bird that is known to scavenge both edible and non-edible items (Tewari, Krishnan, Valsalan, & Roy, 1995). Pica is not a newly recognized phenomenon, but appears to have been recognized for centuries, as can be noted by its presence as part of some religious practices such as anthrophagy in Christianity. Historically, many medical terms have been used to refer to deviations in appetite or cravings for specific substances, including picatio, picacia, pseudorexia, malacia, citta, allotriophagia, hapsicoria, pellacia, geophagia, and geomania (Parry-Jones & Parry-Jones, 1992).

Occurrences of pica or deviations in appetite were first reported as early as the Greeks and Romans in the 16th Century, with higher prevalence rates found among young children and pregnant women (Parry-Jones & Parry-Jones, 1992). Pica is still a phenomenon that is reported frequently within the literature and encompasses a multitude of specific topographies (see Table 1). Pica may involve either nonfood items or food items that are consid-

TABLE 1

Epidemiology

Study	*Pica Definition*	*Method*	*Population Setting (n)*	*Population Characteristics*	*Prevalence (%)*
Tewari et al. (1995)	Eating non-food items & inappropriate food items (ice cold, frozen food, & food discarded in trash or on floor)	Information solicited from senior nursing staff	Learning Disability Hospital (246)	Learning disabled, adults (24–79 years), minimum 2 years stay in hospital	10.1% (male to female ratio 1.4:1 for those identified with pica)
Bhandari & Agarwala (1996)	Not Stated	Self-report, 5 item questionnaire	Co-educational School in India (500)	School age, otherwise not stated	6% (1.6% with duration of 2–4 years)
Lohiya et al. (1996)	Not Stated	Not Stated	Institution (323; 66)	Mental retardation	77% (250 of 323 in 1977); 16.7% (11 of 66 in 1994)
Tracy et al. (1996)	Habit of putting objects in mouth indiscriminately	Elgin Behavior Rating Scale (EBRS)	State Hospital (400)	Schizophrenia Disorder (any subtype), adults	3%
Applegate, Matson, & Cherry (1999)	Not stated, but not co-occurring with SIB, stereotypy, aggression, or rumination	Not Stated	Developmental Center (417)	Severe or profound mental retardation	7.2% (24 male & 6 female; age range 24–79 for those identified with pica)
Matson & Bamburg (1999)	*DSM-IV* criteria	Psychological & functional assessment	Institution (790)	Mental retardation, age range from 17 to 80 years	5.7%
Rowland (1999)	Not specifically stated, but referred to as a generalized tendency to ingest or "bolt" to food	Gleaned from screening data regarding aberrant eating behaviors	Residential Learning Disability Facility (110)	Learning disabled, adults (age range 21–65 years)	15.4% (8 individuals identified with co-occurring polydipsia)
Swift et al. (1999)	Frequent consumption of non-food and food related substances	Survey questionnaire, verbal questioning, and/or review of medical problems	Residential Facility (689)	Developmentally disabled adults	22.1% (male to female ratio 1.5:1 ranging in age from 24 to 77 years for those identified with pica)

ered inappropriate for consumption due to lack of preparation, decomposition, or that do not have sufficient caloric value to maintain physical health. Eating nonfood substances has been observed in both animals and humans. Grazing herds of cattle have been noted to engage in eating of bones (osteophagia; Parry-Jones & Parry-Jones) and domestic cats have also been observed to engage in pica (Bradshaw, Neville, & Sawyer, 1997).

Pica may involve generalized items (Danford & Huber, 1982) and discrete classes of items such as tobaccophagia (Piazza, Hanley, & Fisher, 1996). Danford and Huber described 36 different types of pica, including both food and nonfood items. Some of the specific pica substances ingested by humans include: paint, plaster, hair, (Hakim-Larson, Voelker, Thomas, & Reinstein, 1997); ice, grass, vinegar, sand, leather, urine, chalk (Parry-Jones & Parry-Jones, 1992); dirt (Goldstein, 1998); and live wasps (Danford & Huber).

Some historical causative explanations of pica include: (a) retention of impure blood due to cessation of menses during pregnancy, (b) delayed development of sexual organs (chlorosis), (c) digestive disorders, (d) iron deficiency, (e) cosmetic reasons, such as to achieve pale skin, (f) sexual frustration, and (g) tight-corseting (Parry-Jones & Parry-Jones, 1992). Although not consistent for all types, pica has been related to factors such as seasonal changes, age, level of mental retardation, and aggression (Danford & Huber, 1982). Some associated detrimental symptomologies of pica reported were lead poisoning (Boris, Owen, & Steiner, 1996), choking (Hakim-Larson et al., 1997), and parasites (Foxx & Martin, 1975).

Some reported treatments for pica, that could be considered unusual, have included vomiting, purging, iron therapy, mineral baths, absinthe and oil figs, ingestion of difficult to digest foods, physical beatings, iron masks, and decapitation (to discourage others from the practice; Parry-Jones & Parry-Jones, 1992). That some of these treatments appear so drastic demonstrates the potential severity of the problem and its resistance to treatment or spontaneous remission. While many of these unusual treatments still occurred in the 20th century, more recent approaches using less intrusive procedures have been demonstrated as effective and will be discussed.

Diagnosis

Parry-Jones and Parry-Jones (1994) reported that pica was consistently identified for two millennia as a false or craving appetite or deliberate ingestion of bizarre food, nonnutritive substances, and/or non-food items. Prior to the 20th Century, pica was not typically recognized as an independent disorder (Hakim-Larson et al., 1997). Pica has commonly been included as a symptom of other diagnoses such as anorexia nervosa, bulimia, and rumination, all of which involve deviations in the typical ingestion of food (Parry-Jones & Parry-Jones). The *DSM-IV* diagnostic criteria for pica include persistent eating of nonnutritive substances for at least one month, which is considered developmentally inappropriate, and with sufficient severity to warrant independent attention from other disorders (APA, 1994).

The *DSM-IV* diagnostic criteria for pica indicate a differentiation based on cultural variables. Paniagua (2000) described this inclusion of specific cultural information as relatively uncommon within the *DSM-IV* and indicated that too much emphasis can be placed on these cultural variables, which may result in failure to identify severe psychiatric disorders. Extending Paniagua's point specifically to pica could lead to failure to provide treatment for behavior that can be life-threatening.

Recommendations have been made to return to classifying pica as a symptom of some other more predominant disorder or condition, while expanding the definition of pica to include subtypes (Parry-Jones & Parry-Jones, 1992, 1994). One specific subtype recommended included excessive cravings for specific foods that are typically considered nonnutritive and low calorie, such as vinegar, spices, or pickles. The rationale for this specific subtype is that it would broaden the definition of pica and potentially encourage studying the relationship of pica with other eating disorders.

Etiology

Research on etiology of pica is limited and typically found under the broader category of eating disorders. Identifying pica as an independent disorder rather than as a symptom associated with other conditions such as eating disorders is different from classification systems used prior to the 20th Century (Hakim-Larson et al., 1997). Most etiological explanations recognize that pica may be multifactorial in origin, including medical explanations such as parasite infestation, inappropriate levels of digestive enzymes or acid levels in stomach, and iron deficiency (Parry-Jones & Parry-Jones, 1992).

Cognitive models of eating disorders have typically focused on three major areas involving disordered sensations of hunger and satiety, conceptual distortions, and perceptual distortions primarily of body image (Mitchell & McCarthy, 2000). Marchi and Cohen (1990) suggested that lack of self-control may be an underlying factor of pica. This suggestion was based on their longitudinal research findings that young children who were picky eaters (representing more self-control) did not develop bulimia in adolescence and that pica behavior in young children (representing a lack of self-control) was correlated with adolescent development of bulimia.

The psychodynamic model explains eating disorders such as pica based on conflicts of unconscious thoughts/feelings as an impetus for the psychopathology. Goldstein (1998) described a case study involving a 33-year-old African American woman who, with no formal psychiatric history, engaged in eating dirt. Although the woman was from a culture in the West Indies known to ingest dirt, it was speculated that the pica was based on two types of unresolved conflict, primarily shame and loss. The shame aspect involved her relationship with her parents and feelings that she was doing something considered "dirty" and unacceptable to her parents. The loss aspect involved repeated miscarriages and her statements about wanting to put some of the fetus back inside herself by eating dirt from the gravesite. The woman did not participate in any treatment.

Lastly, the multidimensional model used to explain eating disorders emphasizes that no single factor operates to maintain or trigger the problems associated with eating disorders (Mitchell & McCarthy, 2000). This model integrates both external and internal factors associated with an individual including social, biological, psychological, and familial influences that contribute within a developmental framework to explain the causes of eating disorders (Bryant-Waugh & Lask, 1995).

Although considerable research has been conducted on feeding and eating disorders, no clear pathogenesis has emerged (Hakim-Larson et al., 1997). One factor that appears most clearly associated with pica is iron deficiency (Parry-Jones & Parry-Jones, 1994). Most causal evidence suggests that eating disorders are produced and maintained through an interaction of a variety of factors previously discussed within individual models (Bryant-Waugh & Lask, 1995). Additional research regarding these interactions of factors may prove to facilitate the etiological understanding of pica.

Assessment

Pica has been assessed through a variety of methods such as "baiting" (Foxx & Martin, 1975; Piazza et al., 1998), use of placebo pica stimulus (Donnelly & Olczak, 1990), X-rays (Burke & Smith, 1999), component analyses (Piazza et al., 1996), and functional analyses (Hirsch & Myles, 1996; Piazza, Hanley, Blakeley-Smith, & Kinsman, 2000). Piazza et al. (1998) described baiting as placing nonfood items, identified by a medical team to be safe for mouthing or consumption, in an area where they could be observed and accessed by the person being assessed. Burke and Smith reported on a case study where X-rays along with staff reports were used to assess prevalence of pica in a 59-year-old male. X-rays were conducted on eight separate occasions over a four- year period during the case study and revealed the absence or presence of specific items ingested (nails). Piazza et al. (1996) described a component analysis that involved offering a 17-year-old male different parts of a cigarette to determine the specific cigarette component that maintained pica.

Other assessment methods have focused on identifying the function of pica behavior in the form of functional assessment. Functional

analyses based on procedures described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) have been reported (Hirsch & Myles, 1996; Piazza et al., 1998) as well as use of brief functional assessment in an effort to understand the causal and maintaining variables associated with pica (Northrup, Fisher, Kahang, Harrell, & Kurtz, 1997). Indirect assessment measures have also been used (Goh et al., 1995; Piazza et al., 1996), especially when pica is presumed maintained by automatic reinforcement. Vollmer (1994) described numerous difficulties in conducting functional analyses on behaviors that are maintained by automatic reinforcement and suggested that assessment procedures be developed to identify specific sources of automatic reinforcement. It appears that one trend in the indirect methods described in the assessment of pica involves identification of specific sources of reinforcement. Goh et al. used indirect methods to demonstrate a preference for hand stimulation over mouth stimulation in a study of automatically reinforced pica. Piazza et al. (1996) used a component analysis to demonstrate that nicotine was the specific source of reinforcement in cigarette pica. Applegate, Matson, and Cherry (1999) reported that the use of the Questions About Behavioral Function Scale may be an adequate means of assessing the function of behaviors that are typically associated with automatic reinforcement such as pica. The study also indicated that treatments including high levels of environmental stimulation, especially around meal and snack time, appear to be warranted.

Assessment of pica is an area that is continually developing and has become more refined through use of functional assessment procedures. These recent advances have begun to emphasize use of functional assessment procedures in identifying specific sources of reinforcement. Vollmer (1994) suggested that identifying the relative value of automatic reinforcement is an important step towards developing an understanding of the reinforcing value associated with these behaviors. Vollmer also encouraged more research demonstrating correlational relationships between problem behaviors and physical ailments. Several studies have reported that pica has been maintained by automatic reinforcement, so current assessment trends for pica appear to be compatible with suggestions made by Vollmer, along with correlations between pica and physical ailments which have been previously demonstrated (Pace & Toyer, 2000).

Treatment

Treatment of pica has changed since the first methods were reported in the 16th Century (Parry-Jones & Parry-Jones, 1994). As detailed by Parry-Jones and Parry-Jones (1992), these initial treatments usually involved recommendations to avoid preventing occurrence of the behavior for fear of causing more severe problems. These authors reported that it was sometimes thought that pregnant women or young children were providing themselves with supplements to their diets, which were needed to avoid nutritional deficiencies, or as a remedy for undiagnosed ailments. The trend toward avoiding reduction of pica behavior, based on the harm this might cause, has recently changed, and the detrimental effects of this behavior typically outweigh any potential benefits.

An additional evolution in the treatment of pica behavior may include use of functional assessment to determine function of the pica and training of replacement behaviors. Prior to incorporation of functional analysis procedures described by Iwata et al. (1982/1994), several studies demonstrated successful techniques for reducing pica. Use of brief physical restraint and a verbal reprimand was demonstrated as an effective treatment for the pica of two 6-year-olds (Bucher, Reykdal, & Albin, 1976). This study used actual food items as the pica items, although the food items were not considered appropriate to eat since the items were placed on the floor. This study also described a procedure that could be considered a possible health risk to implement (placing the child on the ground with the experimenter's knee pressed lightly on the child's back).

Foxx and Martin (1975) demonstrated the use of overcorrection procedures to reduce scavenging for pica items behavior of four adults diagnosed with mental retardation. Results of this study included a recognizable change in health status such as increase in appetites and body weight for three of the adults by freeing them from persistent intesti-

nal parasites that were maintained by coprophagy. These studies differ from more recent studies incorporating intrusive procedures such as punishment (e.g., Fisher, Piazza, Bowman, Kurtz, Herer, & Lachman, 1994) in that the procedures were not based on functional assessment procedures.

The following provides a review of some of the more recent procedures used in treatment of pica. These procedures are presented in a manner that attempts to group them according to the underlying etiological model that the treatments generally represent, although some treatments are based in a combination of etiological models. These treatments are also presented in Table 2 for reference purposes.

Medical Model

Successful treatment of pica has been demonstrated with medical interventions designed to treat associated conditions. Boris et al. (1996) reported the disappearance of pica in an 11-year-old African American male following treatment of hypersomnolence and lead poisoning with methylphenidate and chelation therapy. Pace and Toyer (2000) employed a B-A-B experimental design using the multivitamin Polyvisol® as the independent variable to reduce the latency to pica in a 9-year, 5-month-old female diagnosed with severe mental retardation, iron deficiency, and anemia. Pica was defined as placement of a nonfood substance (cloth fragments, string, synthetic fibers) on or past the lips.

Beecroft, Bach, Tunstall, and Howard (1998) presented a case study of a 75-year-old woman diagnosed with schizophrenia and a 20-year history of pica. Her pica had historically consisted of Dexedrine and Vitamin C, and at the time of assessment consisted of tablets, coins, nuts, wire, plastic, "purple hearts", Bob Martin's dog, conditioning powder, and dried flowers. Treatment consisted of a medical and cognitive-behavioral approach that involved differential reinforcement of vitamin C consumption. Reinforcement involved encouragement, persuasion, a constant supply of vitamin C, and an attempt to provide a stress and confrontation-free environment. The treatment was judged as partially successful.

Cognitive Model

Treatments incorporating a cognitive etiological model do not appear to be frequently reported in the literature. Although references to anxiety and/or frustration as an associated factor with pica have been noted for many years, relatively few documented cases appear to exist which incorporate an experimental design to measure the phenomenon. Bhandari and Agarwala (1996) reported on effects of self-monitoring alone and self-monitoring plus progressive relaxation in the treatment of pica for four boys and four girls aged 15-17 with normal intelligence. Although there were several limitations within the design used and the method of data collection, it was reported that both treatments produced near zero levels of pica during treatment using either condition, but only self-monitoring with progressive relaxation maintained zero levels during follow-up probes. Their definition of pica was not specific and was referred to as eating non-food items. They indicated that the self-monitoring with progressive relaxation may have had better long term effectiveness due to skills taught to reduce anxiety, which they deemed an associated characteristic of pica.

Behavioral Model

Treatments using behavior analysis techniques have been frequently reported in the literature. Pica has been addressed through single interventions such as: (a) vitamin supplementation (Pace & Toyer, 2000), (b) multiple component treatment packages (Fisher, Piazza, Bowman, Kurtz, Herer, & Lachman, 1994; Goh et al., 1999), (c) punishment (Fisher et al., 1994; Foxx & Martin, 1975; Matson, Stephens, & Smith, 1978), (d) protective equipment (Mace & Knight, 1986), and (e) response blocking and redirection (Hagopian & Adelinis, 2001).

Hagopian and Adelinis (2001) used response blocking and redirection with a 26-year-old man diagnosed with moderate mental retardation and bipolar disorder, who displayed multiple substance pica (paper, pencils, paint chips, and human feces). These authors found that physically blocking pica attempts alone increased the frequency of ag-

TABLE 2

Recent (1990–2002) Treatments of Pica

Study	*Primary Treatment*	*Definition of Pica*	*Population (n)*	*Functional Assessment*	*Experimental Design*	*Measure of Effectiveness*
Beecroft et al. (1998)	Vitamin C consumption used as alternative behavior & stress free environment	Not clearly stated, but involved consumption of inedibles (coins, steel nuts, etc.) and efforts to gain access to such items	(1) 75-year-old female diagnosed with schizophrenia, living in residential care	Not conducted	Repeated X-rays and staff reports	Judged to be partially successful
Bhandari & Agarwala (1996)	Self-monitoring alone & self-monitoring with progressive relaxation	Not stated, but referred to as morbid appetite for substances which are not food stuffs	(8) 4 males & 4 females age 15–17 years, with self-reported engagement in pica for 2–4 years	Not conducted	Multiple treatment design, (AB) with follow-up probes	Both treatments independently produced zero self-reported occurrence of pica, but only self-monitoring with progressive relaxation maintained during follow-up probes
Boris et al. (1996)	Methylphenidate & chelation therapy	Not clearly stated, but described as putting inanimate objects in mouth twice	(1) 11-year-old black male with 4-year history of hypersomnolence & chronic lead intoxication	Not conducted	Pre-intervention direct observation & pre & post intervention measures of blood lead levels	Unknown, initial reduction in blood lead levels upon treatment, but returned to unacceptable levels during follow-up
Burke & Smith (1999)	Multiple environmental modifications (“pica proofing”, iron supplements, increased activities, discrimination training)	Staff reports of hoarding of small objects	(1) 59-year-old male identified with a psychiatric or developmental disorder	Not conducted	Case report	Staff reports of decreased hoarding and reduced foreign objects observed during 8 X-rays over a four year period

Donnelly & Olezak (1990)	Differential reinforcement of incompatible behavior (DRI)	Picking up a placebo pica stimulus (participants had been observed to not pick up pica items without attempting to ingest them)	(2) Adult males ranging in age from 38 to 44 years, diagnosed with mental retardation living in a residential facility	Not conducted	Single subject ABAB	Latency to pica increased with intervention with concomitant reduction of pica to near zero levels, additional subject dropped from study following spontaneous remission of pica
Goh, Iwata, & Kahng (1999)	Differential reinforcement with alternative edibles	Placement of cigarette product past the plane of the upper and lower lips	(4) Three males and one female ranging in age from 40 to 49 years, diagnosed with severe to profound mental retardation	Not conducted	Multiple baseline across subjects	Pica reduced for 3 of 4 participants by DRA with alternative edibles
Hirsch & Myles (1996)	Pica box (combination discrimination training & redirection)	Stopping current activities to search for items to eat (i.e., diaper, mattress stuffing, rocks, dirt, grass, paper)	(1) 10-year-old girl diagnosed with pica and autism	Functional analysis revealed pica was not used to escape tasks, to gain attention, or earn tangible rewards	Single subject research, ABAB design	Intervention resulted in a reduction in pica attempts
Northrup et al. (1997)	Differential reinforcement of other behavior (DRO) and time-out	Any attempt to put inedible objects (paper, plastic, or smoking materials) in her mouth	(1) 35-year-old, nonverbal female functioning in the severe range of mental retardation	Brief functional assessment revealed high rates across all conditions	Multiple schedules design with reversals	Treatment effective when implemented at 50% of initial treatment recommendations or higher (75% & 100%)
Pace & Toyer (2000)	Multivitamin vitamin therapy	Placement of a nonfood substance on or past the lips	(1) 9-year-5-month-old girl diagnosed with severe mental retardation, iron deficiency, anemia	Not conducted	Single Subject, (BAB)	An increase in latency to pica was observed with the use of multivitamin

TABLE 2—(*Continued*)

Study	*Primary Treatment*	*Definition of Pica*	*Population (n)*	*Functional Assessment*	*Experimental Design*	*Measure of Effectiveness*
Piazza et al. (1998)	Noncontingent reinforcement	Placing a baited item or any other nonedible item past the plane of the lips	(3) Two females ages 4 & 17, & one male age 5 all diagnosed with mental retardation	Functional analysis—identified automatic and/or social reinforcement	Multielemental and reversal designs	Treatments based on hypothesized function of pica reduced rates of pica more than treatments unrelated to hypothesized function for two of three participants
Piazza et al. (2000)	Search skills training (differential reinforcement of alternative behavior through independent access)	Placement of hands or clothes past the plane of the lips, or tongue contact to hands, clothes, walls, or floor	(1) 9-year-old boy diagnosed with profound mental retardation, plumbism, cortical blindness, and spastic quadriplegia, SIB was also displayed	Pica displayed persistently across all conditions of functional analysis for SIB	Single subject ABAB design	Treatment reduced %age of sessions with pica and increased %age of sessions with appropriate mouthing
Piazza, Hanley, & Fisher (1996)	Noncontingent reinforcement, response interruption, and stimulus control	Placing any part of a cigarette butt or pieces of a cigarette on or past the lips	(1) 17-year-old male diagnosed with severe mental retardation	Functional analysis using multi-elemental design identified automatic reinforcement	Multielemental design and reversal	Treatment reduced pica to zero and transfer to stimulus control produced zero rates of pica
Piazza et al. (2002)	Alternative items and response effort	Placing one of the baited items from the session room past the lips	(3) 14 to 19-year-old females with severe mental retardation	Functional analysis using multi-elemental design identified automatic reinforcement	Multielemental design	Response effort analysis demonstrated a reduction in pica when alternative items were available

gression. However, redirection to an alternative preferred food item (popcorn) in conjunction with response blocking was effective in producing reduction in pica rates. Noncontingent access to popcorn alone did not suppress pica. Combined effects of blocking and redirection were determined to be necessary components of treatment. Piazza, Roane, Keeney, Boney, and Abt (2002) found a reduction in automatically reinforced pica behavior with three participants when alternative items were available. Their study varied the response effort associated with accessing pica items and alternative items. They found that the responses allocated toward pica or alternative items varied, based on amount of response effort necessary to access the items. More responses were allocated toward items with lower response effort for all three participants.

Goh et al. (1995) used a pica exchange procedure in which the individual was taught to turn inedible items over to staff in exchange for highly preferred edible items. Results indicated that for three of four participants, offering a highly preferred edible reinforcer contingent on the individual turning in cigarette butts to staff was effective in reducing overall pica rates. Prior to implementation of the pica exchange, a multi-component preference assessment was conducted to determine which properties of cigarettes were reinforcing for each of the four individuals. For one of the individuals, alternative food items were not preferred over cigarettes, and therefore it was determined that pica exchange would not be an effective treatment for this individual.

The strength necessary to effectively maintain low levels of pica with differential reinforcement of an alternative behavior (DRA) and a brief time-out were assessed using an experimental design for a 35-year-old female functioning in the severe range of MR (Northrup et al., 1997). Pica was defined as her attempt to put inedible objects (paper, plastic, or smoking related materials) in her mouth. Results of the study indicated that pica was successfully maintained at low levels with 50% implementation of the time-out procedure. This study suggests that DRA and brief time-out may be an effective treatment for pica even when implemented at less than a continuous schedule and that fading of treatment for pica might be done more rapidly than had been previously demonstrated.

Piazza et al. (1996) demonstrated that pica behavior could be placed under stimulus control by associating a purple card with treatment using noncontingent reinforcement and response interruption. Cigarette butt pica of a 17-year-old male with severe MR was reduced to zero across multiple environments when he was provided free access to edibles, environmentally associated activities, and a purple card. Pre-treatment assessments conducted in the study revealed: (a) nicotine as a factor maintaining pica (over herbal cigarettes), (b) preference for tobacco over other parts of a cigarette, and (c) automatic reinforcement as a maintaining variable. The study also described an example of covert pica that involved hiding pica items in shoes, under arms, or in pockets for later consumption.

Piazza et al. (1998) conducted a study of three participants' (two females and one male ranging from 4 to 17-years of age) pica behavior that revealed that automatic reinforcement was primarily responsible for one participant's behavior and partially responsible for the behavior of the other two participants. Treatments based on the hypothesized functional topography of oral stimulation were more effective than treatments unrelated to hypothesized function for two participants.

Piazza et al. (2000) trained a blind boy with profound MR to search out and independently access alternative sources of reinforcement to replace pica behavior. The boy was 9-years-old and had been diagnosed with profound MR, spastic quadriplegia, plumbism (lead poisoning), and cortical blindness. Pica was defined as placement of hands or clothes past the plane of the lips, or tongue contact to hands, clothes, walls, or floor. The training consisted of 12 sessions of direct instruction in the use of strings used to locate appropriate mouthing toys. The direct instruction was faded until the participant independently accessed the toys via use of the strings as guidance. This training reduced the pica to near zero within an A-B-A-B experimental design, while increasing what was considered appropriate mouthing of toys.

Summary

Donnelly and Olczak (1990) stated that the most frequently reported interventions in the literature for pica were time-out, restraint, and overcorrection, although they reported a recent overall trend toward using less restrictive interventions. A limited review of the literature on the treatments for pica from 1990 to 2002 does not indicate a continuation of frequent reports of those treatments noted by Donnelly and Olczak. In contrast, the trend in treatment of pica most recently indicates a movement toward the use of more alternative reinforcement procedures, matching the recent trend reported by Donnelly and Olczak. A rationale for this trend may be the result of a more widespread use of functional assessment procedures paired with less restrictive interventions and recognition of effective procedures that are less time intensive. The trend toward using less restrictive interventions in the treatment of pica may have developed more slowly than treatments for other topographies of behavior, possibly due to low prevalence rates of the behavior with recent prevalence rates ranging from 3 to 22% (Swift et al., 1999; Tracy, de Leon, Ghayyur, McCann, McGrory, & Josiassen, 1996). Less restrictive treatments for pica may have been slower to develop due to difficulties inherent in treating behaviors considered to be maintained by automatic reinforcement.

Burke and Smith (1999) suggest that additional research is needed to examine the effects of procedures that consider the least intrusive options available. They presented a case study which utilized a number of environmental controls including "pica proofing" and administration of an iron supplement along with discrimination training to reduce the pica of a 59-year-old male identified with a psychiatric or developmental disorder, which was maintained at a 5-year follow-up.

Treatments reviewed for pica represent several different underlying etiological models, with the most frequently reported treatments having an underlying basis in a behavioral model. The behavioral model, by including the use of functional assessment techniques, appears to have some potential for addressing the underlying assumptions of many models. Functional behavioral assessment can provide evidence of: (a) underlying medical conditions, (b) problems with social interactions as typically referred to in a familial model, and (c) discrimination problems that could be interpreted as cognitive dissonance within a cognitive model.

Pica has a long history of occurrence with a multitude of topographies being described. Considering recent prevalence estimates (from 3 to 22%), it would appear that current research literature provides a proportional reflection of the treatment actually being provided, although current research may not be an accurate reflection of the efficacy of interventions presented in published studies. As pointed out by Vollmer (1994), success rates of treatments based on automatically reinforced behavior may be lower than a review of the literature might suggest because treatment failures are not usually reported.

Current trends in assessment appear to include evaluation of specific sources of reinforcement as suggested by Vollmer (1994) as well as incorporation of more indirect methods that indicate correlational relationships. These forms of assessment, coupled with use of less intrusive interventions that involve multiple environmental manipulations provided in the form of treatment packages, have become the norm with regard to treating the condition. Future research involving pica may incorporate more emphasis on the histories of reinforcement involved in the development of the phenomenon and possibly the effects of both proximal and distal variables on the occurrence of pica.

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