Pergamon

Research in Developmental Disabilities, Vol. 15, No. 1, pp. 19–37, 1994

0891-4222/94 $6.00 + .00

0891-4222(94)E0002-P

Sentence Combining as a Technique for Increasing Adjective Use in Writing by Students With Autism

Marilyn K. Rousseau

The City College of the City University of New York

Patricia J. Krantz

The Princeton Child Development Institute

Claire L. Poulson

Queens College of the City University of New York

Mary E. Kitson and Lynn E. McClannahan

The Princeton Child Development Institute

A multiple-baseline across-subjects design was used to determine whether reinforcement alone or in combination with sentence-combining exercises would increase the number of descriptive adjectives used in daily writing samples by three adolescents with autism. The cumulative number of new adjectives (adjectives never before used by a student in the entire study) was also recorded. Experimental conditions were baseline, sentence combining, and maintenance. Writing sessions consisted of a 20-min worksheet period followed by a 20-min writing period. The addition of sentence-combining exercises increased the number of adjectives in the students' writing samples. Maintenance of this increase occurred in the absence of sentence-combining lessons and in the presence of reinforcement for use of adjectives. The addition of sentence-combining exercises also increased the cumulative number of new adjectives, although

Financial support for this study was made available by a Professional Staff Congress/City University of New York Research Grant (667400). Appreciation is expressed to Brian Bottge for development of the sentence-combining exercises.

Requests for reprints should be sent to Marilyn K. Rousseau, Department of School Services, R3/227 NAC, The City College of New York, Convent Avenue at 138th Street, New York, NY 10031.

new adjectives did not occasion reinforcement, and we had not expected their use to increase in students with autism without specific instruction. Maintenance of new adjective use also was demonstrated. Finally, for all three students, minimal terminable unit (T-unit) length, a measure that facilitates comparison with normative data, increased from baseline to maintenance, and independent raters judged writing samples written during maintenance as better than those written during baseline.

Children with autism often exhibit the most extreme forms of expressive and receptive language deficits. Indeed, severe language delay is one of the defining characteristics of autism (Ritvo & Freeman, 1978), and unless the language delay is ameliorated as early as possible, children with autism stand little chance of developing academic or social skills commensurate with their chronological ages (Fenske, Zalenski, Krantz, McClannahan, 1985; Lovaas, 1987). Researchers have examined effective intervention techniques for developing oral language skills with children with autism (Barrera & Sulzer-Azaroff, 1983; Lovaas, 1977; Matson, Sevin, Fridley, & Love, 1990; McGee, Krantz, Mason, & McClannahan, 1983; McGee, Krantz, & McClannahan, 1985; Secan, Egel, & Tilley, 1989), but to date there have been no studies of methods to increase their written language proficiency. This situation is true despite the fact that written language skills are just as important to academic success as reading and arithmetic.

There have been important advances in written language research with normally developing children in the past 30 years. Much of this research focused on ways to describe and measure written language (Bartholomae, 1980; Hunt, 1965, 1970, 1977; Lloyd-Jones, 1977; Loban, 1976; O'Donnell, Griffin, & Norris, 1967; Shaughnessy, 1977; Weaver, 1982). Hunt (1965) established the T-unit as a measure of syntactic maturity, or the amount of information conveyed in a unit of writing. A T-unit is an independent clause and any dependent clauses attached to or embedded in it (Hunt, 1977), and it is the smallest unit of written language that can stand alone grammatically. An example of a T-unit is: "After eating dinner, Gary rode his bike." "After eating dinner" is a dependent clause, and "Gary rode his bike" is an independent clause. Together, they comprise one T-unit.

In seeking ways in which to improve students' syntactic maturity, Hunt (1965) concluded that increasing clause length was the most effective way of increasing T-unit length and that increasing the number of noun modifiers per clause was the simplest way to increase clause length. Hunt's data showed that adjectives were the most commonly used noun modifiers among students at all grade levels. Weaver (1979) reported that sentence-combining exercises are one of the best ways to teach the use of adjectivals. Sentence combining requires the student to combine two or more short, simple sentences to produce a single, more mature sentence. For

example, the following T-units (a) "Helen painted a picture," and (b) "The picture was pretty," can be combined into one T-unit, "Helen painted a pretty picture." Sentence combining has been used with students in regular classes to increase clauses, phrases, adjectives, gerunds, (Mellon, 1969; O'Hare, 1973), and quality of writing (Hillocks, 1984).

No studies have reported the use of sentence combining to increase the writing skills of students with disabilities, and no behavior-analytic studies have been published on the use of sentence combining to increase the use of descriptive adjectives. In a behavior-analytic study, Van Houten and MacLellan (1981) examined the effects of performance feedback and sentence combining on the T-unit lengths of two 11th-grade academic English classes. They found that feedback alone produced an increase in T-unit length. Nevertheless, the addition of sentence-combining exercises produced a further increase in T-unit length. Van Houten and MacLellan concluded that the treatment package could increase students' T-unit lengths to levels comparable to that of professional writers.

Several researchers have studied ways to increase the use of adjectives using a variety of feedback and reinforcement procedures (Ballard & Glynn, 1975; Harris & Graham, 1985; Heward & Eachus, 1979; Kraetsch, 1981; Maloney & Hopkins, 1973; Maloney, Jacobson, & Hopkins, 1975). Three of the these studies involved students with handicaps: one with students of normal intelligence who were hearing impaired and two with students with learning disabilities. Heward and Eachus (1979) used a point system to improve the writing skills of four students with hearing impairments in a specially constructed classroom in a residential school. Harris and Graham (1985) used a self-control strategy to increase the use of action verbs, adverbs, and adjectives. The authors also reported improved story quality as the result of the intervention procedure. Finally, Kraetsch (1981), in a case study of a 12-year-old student with a learning disability, reported an increase in the use of adjectives as the result of oral instructions given by the teacher.

We limited our study to adjectives because the severe level of expressive language delay of the autistic students suggested that we should begin with a simple goal. Furthermore, we knew from writing samples collected previous to this study that these autistic children rarely used descriptive adjectives. A more general reason for working with adjectives is that they contribute to clear communication by giving vividness, accuracy, and concreteness to writing (Surmelian, 1969), qualities that the writing of these autistic students lacked. Finally, adjectives often serve as essential cohesive links between sentences (Halliday & Hasan, 1976), and if we found that we could teach the use of adjectives to autistic children, we might be able to teach them other, more complicated cohesive ties in writing.

A second focus of this research was the sentence-combining procedure itself. Although sentence combining has been advocated as an effective intervention for increasing students' use of particular grammatical structures (Cooper, 1973; Schuster, 1980; Weaver, 1979), there have been no studies in the educational literature that separated the effects of sentence combining from the effects of reinforcement alone. Obviously, if reinforcement alone would produce an increase in descriptive adjectives used, there would be no need for the sentence-combining exercises.

The appeal of sentence combining as an intervention procedure for students with autism is that it requires no formal instruction in grammar. Its disadvantage is that there is no commercially available sentence-combining curriculum for the limited language and reading levels of students with autism.

In this study we examined the effect of sentence-combining exercises on the number of descriptive adjectives used by students with autism. Although we did not expect these autistic students to use new adjectives in their writing spontaneously, we recorded their occurrence. Recording the number of new adjectives allowed us to determine the extent to which they merely repeated the same adjectives in their writing samples. In addition, we examined the writing samples for increased T-unit length and for overall improvement in the students' writing, as judged by independent raters.

METHOD

Subjects

Three adolescents, Brody (age 13 years 7 months), Brock (age 11 years 3 months), and Ann (age 13 years 7 months), participated. They had attended the Princeton Child Development Institute (PCDI) for 9, 6, and 7 years, respectively. All three students were diagnosed as having autism by an independent agency when they were between 30 and 36 months of age. Their age-equivalent scores on the Peabody Picture Vocabulary Test–Revised were 5 years 8 months for Brody, 5 years 8 months for Brock, and 7 years 3 months for Ann. Their full-scale IQ scores on the Wechsler Intelligence Scale for Children–Revised were 45, 57, and 74, respectively. Age equivalents in communication measured by the Vineland Adaptive Behavior Scales were 6 years 4 months for Brody, 9 years 8 months for Brock, and 9 years 8 months for Ann.

The students attended classes full-time at PCDI, and they received instruction in academic subjects and physical education much the same as they would in a regular public school. Long-range goals as stated on the Individual Educational Programs for each student included development of skills in written language expression.

Setting

Classrooms at PCDI are designed to accommodate individual and small-group lessons and include standard classroom equipment. To the maximum extent possible, students are taught in small groups so they learn to function in as normal a classroom environment as possible. All experimental sessions took place in the language-arts class, which consisted of the three students in the study. Each student worked at his or her individual desk.

Materials

Sentence-combining exercises (O'Hare, 1973; Schuster, 1980), written by a graduate student in Special Education, were used to teach the use of descriptive adjectives. These exercises had been used successfully in a previous study (Rousseau, Poulson, Maxwell, Feldman, & Deitrich, 1984) of sentence combining with academically retarded students in a class for behavior-disordered students and were not modified for this study. Each lesson included three practice exercises and seven additional exercises to be completed independently by the student. Briefly, each exercise consisted of two or three short simple sentences that could be combined into one longer sentence. For example, the following sentences can be combined into one: "The boy went home. The boy was little." The combined sentence would be, "The little boy went home."

Commercially available color photographs, 8 × 10 in (21.59 × 27.94 cm) and 12 × 17 in (30.48 × 43.18 cm), similar to the photograph used for expressive writing in the National Assessment of Educational Progress (Lloyd-Jones, 1977), provided the stimuli for the writing samples. There were 112 different photographs depicting scenes like a child hugging an adult or children playing basketball.

Procedure

Experimental sessions took place 5 days per week. Each daily session was divided into two periods; a 20-min worksheet period followed by a 20-min writing period. During the worksheet period the student completed tasks appropriate to the experimental condition in effect, such as during baseline, completing a worksheet on reading comprehension, or, during treatment, completing sentence-combining exercises. During the writing period in all conditions, the students wrote about the pictures. To control for the possibility that some pictures might evoke more descriptive adjectives than others, the pictures were randomly assigned to groups of three and systematically rotated among the students so that each student wrote about a different picture each day. Prior to beginning the study, we random-

ly selected approximately 30 photographs to be reused because there were more experimental sessions than photographs. Each photograph was numbered; then, using a table of random numbers, we selected 30 for reuse. Sessions in which the photographs were reused were randomly selected in the same manner.

Reinforcement. General reinforcement procedures already in effect as a part of the students' daily routine were as follows: (a) descriptive praise for all correct responses to the teacher's direct instructions, such as "Pick up your pencil," and for correct responses on assignments; (b) up to 10 pennies for appropriate work habits, such as working independently, raising the hand to answer questions, and for neat handwriting; and (c) up to 5 pennies per day for emitting no more than one wrong answer per assignment. These procedures were used throughout the school day. To gain access to edible reinforcers available at the end of the school day, individual students had to earn at least 20 cents during one period of the session. These general reinforcement procedures remained in effect throughout the study.

Reinforcement procedures specific to this study were as follows:

1. Worksheet periods. Throughout all experimental conditions, students earned pennies for correct responding on the reading comprehension or sentence-combining worksheets during the 20-min worksheet period. As soon as a student completed a worksheet, the teacher scored it with the student and awarded pennies immediately.
2. Writing periods. After each writing period, except during nonreinforced baseline, the teacher reviewed the writing sample with the student and awarded 1 penny for each adjective used correctly. Incorrect use of adjectives was not reinforced or included in the adjective count.

Dependent measures. The primary dependent measure was number of adjectives per T-unit. A T-unit was defined as an independent clause including any dependent clauses attached to or embedded in it (Hunt, 1970). The number of adjectives per T-unit was used as the basis for measuring changes in adjectives because it allows for comparisons of changes across students regardless of the length of their compositions. Thus, it provided some measure of standardization (Rousseau, 1990; Van Houten, 1979). Adjectives per T-unit were calculated by dividing the number of adjectives by the number of T-units in a given writing sample.

An adjective was defined as a word describing or modifying a noun and limiting its meaning. Included were predicate adjectives, adjectivals, participles, gerunds, and infinitives used as adjectives. Demonstratives, numericals, articles, and interrogatives were not counted as adjectives. The repeated use of the same adjective among consecutive words (e.g., "The

old, old, old, man") or phrases (e.g., "The old man, the old woman, the old dog, the old cat") was counted as one occurrence of that adjective. This rule was implemented to discourage students' repetitive use of individual adjectives (Van Houten, 1979).

Differential reinforcement contingencies were not introduced for using new adjectives (defined later) or for increased T-unit length because there was no evidence that these autistic students were capable of increasing these responses in the absence of special curricular materials to teach them. We did not think it fair to the students to impose contingencies that we had no reason to believe they could successfully meet.

New adjectives and T-unit length. A new adjective was one that a given student had not used in any previous writing samples from baseline through maintenance. We separated new adjectives into two groups: those that were used in the sentence-combining exercises, and those that were not. T-unit length was calculated by dividing the number of words in a sample by the number of T-units to obtain an average number of words per T-unit. The primary reason for measuring overall changes in T-unit length was to allow comparisons with normative data (Van Houten, 1979).

Fidelity of treatment. During all experimental sessions, the teacher checked off each step of the procedure on a checklist. The steps included presentation of correct materials and instructions, recording of starting and stopping times, scoring and recording of student work, and delivery of reinforcers.

Judgment of quality. Judgment of quality was calculated on five writing samples from baseline and five from maintenance for each student. Samples selected for scoring were those with the number of adjectives closest to the mean number of adjectives for a given student for a given condition. Samples closest to the mean were selected to exclude extreme examples within pairs that might signal the readers as to which condition a sample was from. Samples from baseline were randomly paired with samples from maintenance for each student. Two independent raters, both graduate students in psychology who were uninformed of the purpose of the study, were asked to give a forced-choice response as to which of the samples in each pair was "better," and which one seemed to show a greater number and variety of descriptive words. Raters were asked to write an explanation as to why they judged the samples as they did.

Experimental Conditions

Nonreinforced (for adjective use) baseline. During the worksheet period, reading-comprehension worksheets were introduced during each session.

This method was followed for two reasons: First, during intervention there would be a daily 20-min sentence-combining lesson, and, thus, a comparable 20-min daily lesson was needed in baseline to equalize instructional time in the baseline and sentence-combining conditions. Second, a comparable amount of reinforcement in baseline and intervention was needed to control for reinforcement effects, and thus, to ensure that sentence combining was the only difference between baseline and intervention.

On each reading comprehension worksheet, the students read a brief story, then answered literal comprehension questions by referring back to the reading. Commercially available stories and worksheets were used.

During the writing period, each student received a colored 12 in (30.48 cm) × 17 in (43.18 cm) picture, lined paper, and a pencil. Students were instructed to write about the picture and told that they had 20 min to write. The teacher told them when to begin and when to stop writing. The teacher did not provide feedback about the student's writing.

Reinforced (for use of adjectives) baseline. During reinforced baseline, the use of reading comprehension worksheets was continued for the worksheet period. At the end of each writing period the teacher reviewed the writing samples with the students individually and awarded the students 1 penny for each descriptive adjective in the sample.

Sentence combining. Sentence-combining exercises, described earlier, were substituted for the reading comprehension exercises in the worksheet period. The teacher introduced the worksheets by demonstrating how to combine the two sentences by inserting the underlined adjective into the first sentence and deleting the caret and the second sentence. The caret was dropped by the 13th exercise. The students worked the remaining sentences individually with help from the teacher as needed. The writing period and reinforcement procedures were the same as in reinforced baseline.

Maintenance. During maintenance, the student completed reading comprehension worksheets like those completed during baseline and earned reinforcers during worksheet and writing periods as described under reinforced baseline.

Experimental Design

A multiple-baseline across-subjects design was used because the written composition skills taught were not expected to be reversible under experimental condition changes. Each student experienced the experimental conditions, described earlier in the following order: nonreinforced and reinforced baseline, sentence combining, and maintenance conditions. Both

reinforced and nonreinforced baselines were used to assess the effect of reinforcement alone on the use of adjectives. That is, we wanted to determine whether reinforcement alone was sufficient to produce an increase in the number or variety of adjectives, as was the case with students with less severe disabilities (Rousseau et al., 1984). Because the full extent of the language abilities of autistic children might not be readily apparent, it seemed especially important to test their repertoires of adjectives in writing before beginning a more time-consuming intervention procedure involving the design or modification of curricular materials. The use of pennies as reinforcers, already demonstrated to be effective for other academic work by these three students, should increase their use of adjectives in writing if they existed in their repertoires.

Interobserver Agreement

Interobserver agreement was calculated on 25% of the daily writing samples and procedural checklists for each experimental condition per student. For writing samples, agreement was calculated separately on number of words, number of T-units, and number of adjectives. Agreement was computed by an item-by-item comparison of scores obtained by one of the researchers and a second observer. Data were calculated as a percentage of agreements by dividing the number of agreements by the number of agreements and disagreements and multiplying by 100 (Sulzer-Azaroff & Mayer, 1977). Quality of writing was scored according to which sample in a pair of samples was judged "better" by two independent raters.

The average interobserver agreement for number of adjectives was 97% (range 90–100%); for T-unit length, 99% (range 98–100%); and for procedures, 99% (range 90–100%). Interobserver agreement on quality was 87% (range 0–100%). In the latter category there were two instances in which zero agreement occurred, and it was because there were only two possibilities for each pair of samples: agreement or disagreement.

RESULTS

Figure 1 shows the mean number of adjectives per T-unit per 2-session unit per condition for each student. Two-session units were used so the data would fit on a journal page.

Although Brody's baseline data showed a slightly increasing trend, Brock and Ann's baselines were stable. The introduction of reinforcement for use of adjectives in their writing was not associated with change over the initial baseline levels for the three students. Brody simply continued to show a slight overall increase throughout the entire baseline.

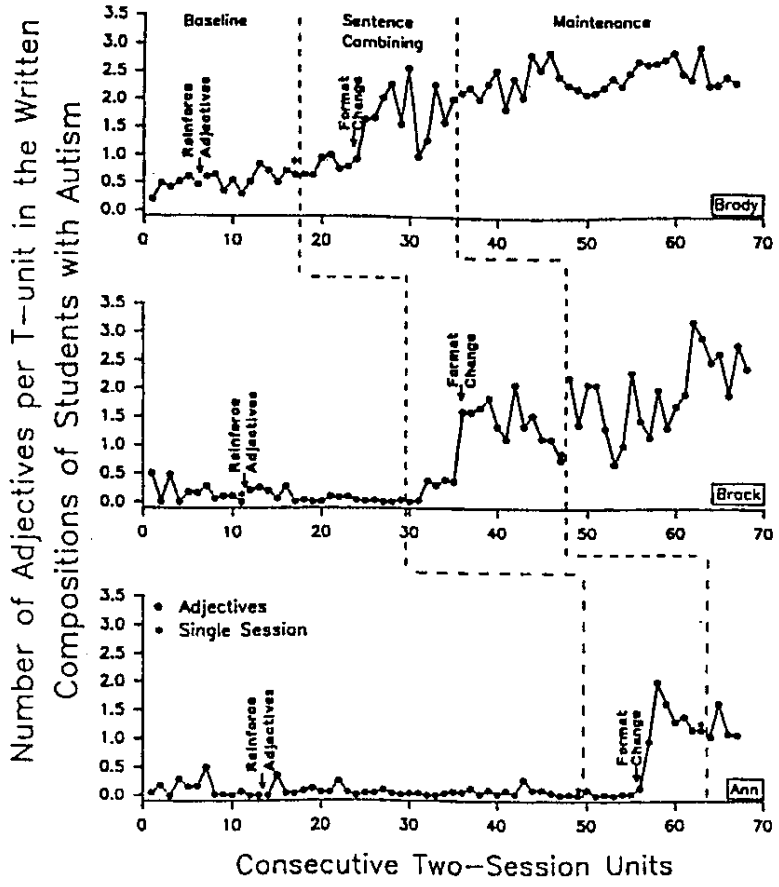

FIGURE 1. Number of adjectives per T-unit in daily writing samples written by three students with autism over baseline, sentence combining, and maintenance experimental conditions. Data are collapsed into 2-session units.

With the introduction of the sentence-combining exercises there was a slight increase in the number of adjectives for Brody and Brock, but no initial increase for Ann. All three students showed an increase after 12 sessions' exposure to the materials (data point 24 on Brody's graph, 36 on Brock's, and 56 on Ann's).

A post hoc evaluation of the sentence-combining materials revealed that the exercises in the first 12 sessions were marked with carets to indicate

where the adjectives should be inserted, and the adjectives themselves were underlined. The caret and underlining of adjectives were omitted after the 12th exercise during the sentence-combining condition. The point at which this format change occurred is shown with arrows in Figure 1. In this study, when the format was changed, the number of adjectives increased substantially for all three students.

Before the format change, all three students were responding to the exercises themselves with 90–100% accuracy. When the format changed, two of the three students' accuracy rates temporarily decreased. Specifically, although Ann continued to respond correctly when the change occurred, Brock dropped to 60% correct on the first exercise with the changed format, before he resumed correct responding. Brody scored only 30% correct on the first changed-format exercise, and it took him six lessons to reach his former level of 100% correct.

As shown in Figure 1, during the sentence-combining condition for all three students, there was an increase in the use of adjectives to over 2.5 per T-unit for Brody, and to over 2.0 per T-unit for Brock and Ann. These high points were followed by slightly decreasing trends for all three students during the remainder of the sentence-combining condition. Nevertheless, the lowest of those scores was still above their respective baseline performances.

As can be seen in Figure 2, the cumulative frequency of new adjectives (solid circles) used by all three students showed increasing trends during both nonreinforced and reinforced baseline conditions. For Brody that trend was most apparent during nonreinforced baseline, and for Brock and Ann the trend was most apparent during reinforced baseline. Nevertheless, following the format change in the sentence-combining exercises (marked by arrows on Fig. 2), there was a systematic further increase in cumulative frequency of new adjectives for all three students.

The cumulative increase in adjectives during baseline reflects the phenomenon of almost every adjective being a new adjective in the initial writing samples. As the cumulative number of writing samples increased over time, proportionately fewer adjectives were new adjectives, but new adjectives increased during sentence combining, nevertheless. In addition, during the sentence-combining condition, there was a systematic increase in the cumulative frequency of new adjectives during writing that had appeared in the sentence-combining exercises (solid triangles) after the format change occurred.

During the maintenance condition, when sentence-combining exercises were discontinued and reinforcement was available for use of adjectives, the cumulative number of new adjectives written by Brody continued to increase and then leveled off. He wrote a total of 81 new adjectives. Brock's use of new adjectives during maintenance leveled off more quickly, and he wrote a total of 79. Ann experienced only eight sessions of main-

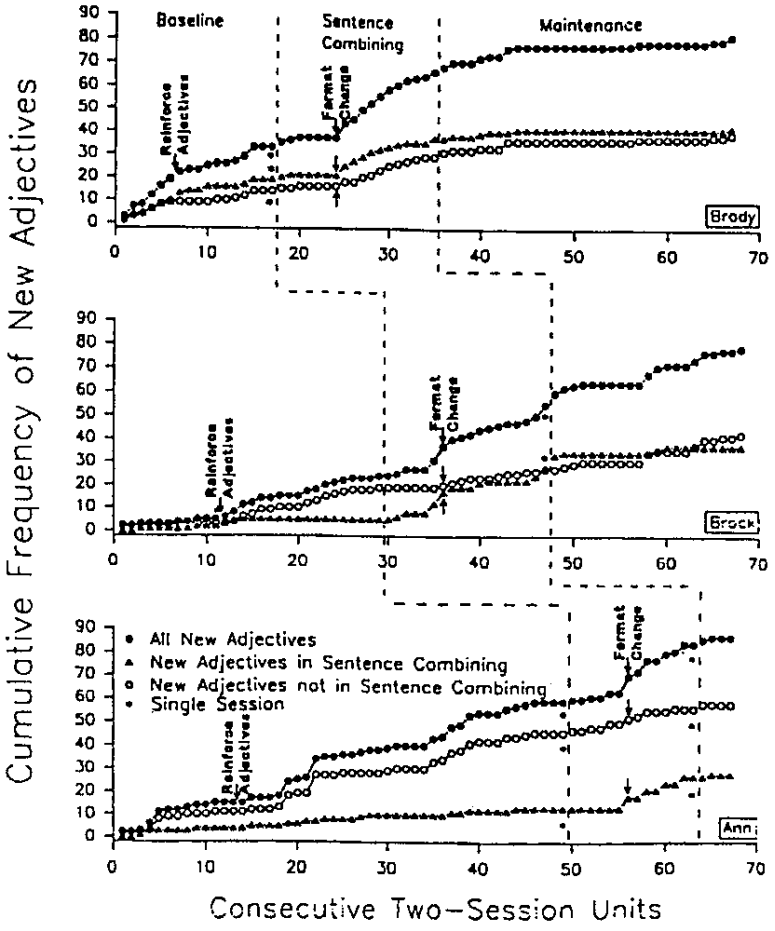

FIGURE 2. Cumulative frequency of new adjectives in daily writing samples written by the same three students over baseline, sentence combining, and maintenance experimental conditions. A new adjective is one that has never before appeared in any of a given student's writing samples throughout all experimental conditions. Solid circles represent the cumulative frequencies of all new adjectives. Solid triangles represent the cumulative frequency of new adjectives that appeared in the sentence-combining exercises. Open circles represent new adjectives that did not appear in the sentence-combining exercises. Data are collapsed into 2-session units.

tenance, but her performance maintained, and she wrote a total of 87 new adjectives during the study. The Appendix lists all adjectives used by each student. Throughout the study all three students used new adjectives that did not appear in the sentence-combining exercises (open circles). It is interesting that the use of new adjectives for all three students reached a plateau at similar levels, because there was no limit on the number of adjectives the students could have used.

We also analyzed the average T-unit length (words per T-unit) for each student's writing samples. These scores increased from baseline averages of 6.00, 4.04, and 4.26 words per T-unit to averages of 6.80, 6.33, and 5.65 for Brody, Brock, and Ann, respectively.

The approximate average T-unit length for children in the eighth grade, the usual grade in school of normally developing children Brody's and Ann's age, is 10.46 words (Rousseau, 1990). Normally developing children Brock's age would be in the sixth grade with an average T-unit length of 8.82 words (Rousseau, 1990). Although all three students with autism are below their peers in average T-unit length, all three showed gains in T-unit length from baseline to maintenance. This increase was not systematic with the introduction of sentence-combining lessons, however, because Brock's T-unit length during sentence-combining actually decreased slightly over his baseline average. Nevertheless, during maintenance the average T-unit length was higher than in baseline for each of the students.

Comparisons with normative data (Rousseau, 1990) show that the increases in T-unit length from baseline to maintenance for all three students was substantial. Hunt (1965, 1977) reported average increases of only .73 to .74 words per T-unit each year between grades 4 and 12. Brody, Brock, and Ann showed increases of .80, 2.29, and 1.39 words per T-unit, respectively. These increases represent a growth rate in T-unit length for Brody comparable to that of normally developing children, but a growth rate of over three times the expected norm for Brock and almost twice the expected norm for Ann.

Social Validation

Two raters independently judged the students' writing samples during maintenance as better than the samples written during baseline. When asked to explain the basis on which their judgments were made, the first rater stated, "Composition is simply expressive language, albeit in written form. The more descriptive the written work, the more it communicates to others. This makes the composition more effective." The second rater

found "less repetition of the same phrase or phrases in the chosen [as belonging to treatment] samples." Finally, both raters found a greater variety of experiences, emotions, ages, color patterns, and items described in the samples written during maintenance and less repetition of phrases, such as "I like."

DISCUSSION

Although there was some variability in the data, the preponderance of evidence suggests that sentence-combining exercises requiring students to combine two or more short sentences into one enhanced the effects of reinforcement in increasing the use of descriptive adjectives in writing samples of three students with autism. Although there is a slight ascending trend during Brody's baseline condition, there is a jump in number of adjectives per T-unit following the format change in the sentence-combining exercises. Therefore, his data fit the pattern of Brock's and Ann's, which, together, show systematic change with treatment.

Treatment effects occurred systematically following the format change (discontinuing the caret and underlining of adjectives) in the sentence-combining exercises. It is interesting that the responses by academically deficient students in a previous study (Rousseau et al., 1984) were not affected by the same format change. Perhaps this finding reflects the unusual characteristics of students with autism. Thus, it is possible that during sentence-combining lessons the autistic students became overly dependent on the visual prompts as discriminative stimuli for using adjectives. Once the carets and underlinings were removed from the exercises and the students began to receive reinforcement for use of adjectives without the visual prompts in the exercises, they began to use adjectives in their writing samples, where, of course, carets and underlining had never appeared. This explanation is supported further by the change in the students' performance on the sentence-combining exercises themselves when the carets and underlining were removed.

It is unclear why all three students eventually showed some decline in adjective use toward the end of the sentence-combining condition. Nevertheless, it is clear that the increase in use of adjectives by Brody and Brock during maintenance conditions might have occurred because of the continued availability of reinforcement for use of adjectives during that condition. Only the sentence-combining exercises were removed during maintenance. Ann's maintenance data might have shown a similar increasing trend had she had more exposure to the maintenance contingencies before the school year ended.

The cumulative frequency of new adjectives showed an ascending trend for all three students during baseline, which is not surprising, given that

during baseline almost any use of an adjective was new. The surprising finding was that there was a systematic further increase in new adjectives over baseline levels with the introduction of treatment, following the format change in the sentence-combining exercises. This was surprising because students with autism frequently emit only those responses that are explicitly reinforced, and they earned reinforcers for use of any adjectives, not for the first use of a given adjective in the study. A further examination of the data sheds light on this finding. Student use of new adjectives that had appeared in the sentence-combining exercises themselves accounts for the increase in use of new adjectives during the sentence-combining condition, as shown in Figure 2. Thus, the sentence-combining exercises themselves are shown to have been functional in increasing use of new adjectives in the writing samples. In addition, students used new adjectives not found in their sentence-combining exercises throughout the study. Perhaps they also incorporated into their writing samples some of the adjectives they were exposed to in their other assignments or in the spoken language around them. Further increases in new adjective use during maintenance may be attributed to the availability of reinforcement for any use of adjectives.

The increases in T-unit length should be viewed with caution. Despite the gains in T-unit length by the students in this study, such gains are important only to the extent that they reflect improvements in the writing skills that were taught. T-unit length is a measure, not an educational goal. One possible explanation for the above-average growth rate in T-unit length for our students is that they were under intensive treatment in school for all academic and social skills, including the use of descriptive adjectives, whereas normally developing students usually do not experience such concentrated work at school.

Judgments of independent raters that the writing samples obtained during maintenance were better than those obtained during baseline provides supporting evidence that the increased use of adjectives by the students resulted in "improved" writing. Taken together, the above findings indicate that the students did not merely repeat a small pool of adjectives, but that they increased the complexity and descriptive quality of their writing by their increased use of new adjectives. The data indicate that the systematic increase in use of new adjectives resulted from the sentence-combining treatment procedure.

It should be noted that the gains in use of adjectives by these students occurred under a very narrow range of training and generalization conditions. That is, no attempt was made in this study to assess or teach appropriate use of adjectives during other activities or in spoken language. Nevertheless, it is encouraging that the sentence-combining curricular procedure was effective to a greater extent than expected with autistic students in their writing class, despite individual differences among students, and

despite the severe communicative handicapping condition of autism. Possibly, for these students, adjectives already formed a preexisting response class, because teaching them the use of some adjectives in the sentence-combining exercises produced appropriate use of other adjectives not directly taught. If that is the case, then it would be appropriate to expose them to contingencies that required their use of an even greater variety of new adjectives in their writing, and in a greater variety of contexts, just as one might with normally developing school children.

It is reassuring to discover that the writing of autistic students can be improved with some of the same technology used to teach writing to their nonhandicapped peers. There is a need to develop and adapt more teaching technology for written language, such as sentence combining, for use by autistic and other severely handicapped students, so we can help them catch up to their nonhandicapped peers in what may be the most neglected of the "three Rs."

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APPENDIX: ADJECTIVES AND ADJECTIVALS USED IN EACH EXPERIMENTAL CONDITION

Brody

Nonreinforced baseline. *Afraid, angry, big, black, *bleeding, blue, brown, *cloudy, curly, dark, dirty, gray, green, happy, hard, *letter, little, nice, red, *real, *runny, soft, sunny, *very, *wheat, white, yellow

Reinforced baseline. Angry, *barn, big, birthday, black, blue, brown, *cloudy, *garbage, gray, green, *Halloween, happy, hard, little, nice, *pink, red, *sad, scared, scary, short, silly, small, soft, striped, tall, *upset, wet, white, yellow

Sentence combining. angry, *baby, beautiful, big, black, blue, brown, *cloudy, cold, *colored, *cotton, *corn, *crying, dark, *different, dirty, fast, fresh, *fun, gray, green, happy, ice cream, large, last, *left, little, light, long, muddy, open, orange, *pink, pretty, red, *round, sad, sandy, *shaggy, shine, *short-sleeve, small, smiling, *smooth, soft, sticky, striped, tall, *tiny, thick, ugly, white, *windy, yellow, young

Maintenance. *baseball, *bathing, big, *bigger, black, blue, broken, brown, *carnation, clear, *colored, *corn, curly, dark, *dry, *garbage, glass, *gold, gray, green, happy, hard, hot, light, little, long, *navy, new nice, old, orange, *pink, purple, *raisin, red, *rocket, shiny, short, silly, *sleeve, smiling, small, *socket, soft, striped, tall, *tree, *washing, white, yellow

Brock

Nonreinforced baseline. *many, nice, *soaking, tall, *tallest

Reinforced baseline. *awful, big, *cereal, *chicken, *Christmas, *Flintstone, *garbage, heavy, *higher, pretty, *railroad, shiny, *special, *stop, *taxi, *terrific, *traffic, *water, *yield-ahead

Sentence combining. angry, apple, American, Bank, big, clean, *cooler, curly, dark, *flag, funny, *government, great, happy, heavy, high, hungry, juicy, little, *loaded, locked, new, old, *public, *ripe, sad, salty, sick, sour, *super-duper, sweet, worried, young

Maintenance. American, big, *blond, *comedy, crowded, dark, *drama, excited, *express, *fantasy, great, happy, *light, little, long, *low, mad, married, *marvelous, *miracle, new, old, pretty, sad, *sand, short, sour, small, *splendid, *square, *stripe, striped, *super, sweet, tall, unhappy, *western

Ann

Nonreinforced baseline. bike, *fall, happy, *Halloween, *Indian, nice, *pumpkin, *road, *rocking, *spray, spring, *strawberry, *thistle, *woolly

Reinforced baseline. *amusement, *art, *bike, *bill, birthday, brick, *bubble, *bumper, *cactus, *carnation, *cashew, *checkered, chocolate, *cookies-and-cream, cool, *crayon, *dry, fast, *flag, *flesh, *fun, *garage, *haunted, hot, *ice, *Indian, *log, *marshmallow, *moon, *paper, *party, *pet, *punch, *rainbow, short, *sky, *slow, *soda, *sweaty, *swing, *stop, tall, *T-ball, *tea, *trench, wooden

Sentence combining. angry, beautiful, big, *blond, cold, *crayon, curly, *engineer's, flat, *flesh, *fluffy, funny, *golden, happy, hard, heavy, *joyful, large, little, *log, long, *plaid, rubber, sharp, shiny, *shopping, short, soft, *straight, *train, *trash, wooden

Maintenance. *blond, hard, long, *plaid, *rough, short, *smooth, woolen

Note. *Adjectives and adjectivals not in sentence-combining exercises.