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Abstract: The ability of children with moderate mental retardation to analyze orally presented sentences into words and words into syllables and phonemes was studied. The subjects, ages 10 to 15, were grouped by method of reading instruction. All of them could analyze spoken sentences into words and words into syllables equally well. However, subjects receiving code-emphasis reading instruction performed significantly better on the more difficult phoneme manipulation tasks than did subjects receiving whole-word instruction. Results suggest that code-emphasis reading instruction for some subjects with mental retardation should be used. Further research on linguistic analysis skills and the use of code-emphasis reading instruction in conjunction with linguistic awareness training with this population is warranted.

The ability to read requires many cognitive skills, such as comprehension, memory, and an awareness of language, that are related to intelligence in different ways (Stanovich, 1985). Research has been conducted to examine short-term memory and semantic lexical access of persons with mental retardation. Results have indicated that text level processing and short-term memory processes may be deficient in this population (Stanovich, 1985). Examination of the comprehension strategies used by persons with mental retardation has demonstrated that information may be lost due to slow verbal coding speed, which may be responsible for poor quality semantic representations (Bilsky, 1985; Stanovich 1985). However, research on the ability of persons with mental retardation to analyze spoken words into their syllable and phoneme segments is lacking.

The relation between the reading ability and linguistic awareness of children in the general population has been well-documented. In particular, the segmentation of words into their component parts, especially words into phonemes, has been highly correlated with later reading ability (Liberman, Shankweiler, Liberman, Fischer, & Carter, 1974; Lundberg, Olofsson, & Wall, 1980; Snowling, Goulandris, Bowlby, & Howell, 1986; Tunmer & Bowey, 1984). Tunmer and Bowey hypothesized that the development of metalinguistic abilities is a reflection of the linguistic skills and an underlying change in the cognitive capabilities of children as a result of maturation. For example, Liberman et al. found that many of their 4-year-old subjects and almost half of the 5-year-olds could segment by syllable, whereas initial phoneme segmentation ability appears in some children at age 5 and increases greatly within the 6th year of life. Although it is clear that the linguistic ability of children with mental retardation is influenced by their level of intelligence (Mecham, 1955), research findings on the nature of the differences are mixed. In general, linguistic development of persons with mental retardation has been found to parallel development of persons without mental retardation (Cromer, 1987; Kamhi & Johnston, 1982; Lackner, 1968), with a significant positive relation between mental age (MA) and linguistic abilities (Walker, Roodin, & Lamb, 1975). However, institutionalized individuals with mental retardation show a decreased oral vocabulary due to a decreased range of experiences (Mein & O'Connor, 1960). They also show a greater difference between receptive and expressive language (Walker et al., 1975) and a decreased ability to use inflectional morphology for lexical items and nonwords (Lovell & Bradbury, 1967). As a result, the majority of the evidence indicates

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that although language development in children with mental retardation follows a sequence similar to that of children without mental retardation, some persons with mental retardation show areas of delay that are not found in children of the same MA who do not have mental retardation..

Much research has been conducted to determine the feasibility and methods of reading instruction for persons with mental retardation. Hermelin and O'Connor (1960) argued that it is possible to teach such individuals to read words. Subsequently, numerous investigators have outlined different methods of teaching students with mental retardation to read, ranging from whole-word sight approaches (Brown et al., 1972; Burney, 1982; Conners & Detterman, 1987; Crossland, 1981; Lally, 1981; Smeets, Lancioni, & Hoogeveen, 1984; Walsh & Lamberts, 1979; Worrall & Singh, 1983)—with varying degrees of success in acquisition, generalization, and retention of the words—to phonic word analysis (J. Singh & Singh, 1985; Nietupski, Williams, & York, 1979). As a result of the reported success in using phonic analysis techniques to decrease the oral reading errors by children with moderate mental retardation, as compared to other instructional techniques (N. Singh & Singh, 1988; J. Singh & Singh, 1985), and the poor retention and generalization found in studies using the whole word approach, it may be possible to teach some children with moderate mental retardation to read using a word analysis approach. In addition to decreasing errors in the training condition, N. Singh and Singh (1988) postulated that children instructed using phonic analysis were able to generalize the techniques that they had been taught. The decrease in errors during subsequent baseline conditions was due to the generalization of phonic analysis, although they may not acquire sound–symbol correspondences and vowel rules spontaneously (Mason, 1978). However, an important factor in learning to read is the ability to analyze spoken language into its component parts (Tunmer & Bowey, 1984). Consequently, in order to use a word analysis approach in learning to read, children with mental retardation should be more successful if they are aware of oral language and its component segments.

The present study was designed to investigate the linguistic analysis skills of subjects with mental retardation. Because children with moderate mental retardation who are between the ages of 10 and 15 have an MA of approximately 5 years or greater, even taking into account a gap between receptive and expressive language abilities, we expected that some of the children would be able to perform tasks indicating linguistic awareness.

Method

Subjects

The 17 subjects, ranging in age from 10 to 15 years, all attended special education classes in public schools for children with moderate mental retardation. They attended one of three classrooms in two school boards in their home town. Four of the 5 subjects in one school board received a code-emphasis approach to reading instruction, with a focus on orthographic patterns and sound–symbol relations. The remaining 13 subjects, 12 of whom were in the second school board and 1 in the other school board, received whole-word reading instruction, with some attention to the initial sounds of words. All subjects had hearing within the average range. They were able to repeat the stimulus words in an intelligible manner, although articulation errors were present in some of their repetitions.

Procedure and Materials

Prior to the testing, the examiner spent some time in each child's classroom, allowing the child to become familiar with her. During this period of time, no attempts were made to train the child on any of the experimental language analysis tasks. To ensure that the stimulus words used in the tasks were part of the subject's oral vocabulary, we reviewed the word list with the classroom teachers. Three tasks were administered in three sessions of 30 minutes each, on different days in order to prevent confusion about the specific task demands. Subjects were seen individually in a quiet room in their own school. They were required to manipulate three units of language: words in sentences, syllables in words, and phonemes in syllables. Colored blocks were used in all of the experimental procedures as a concrete visual aid. The subjects' responses were recorded on paper and audiotaped.

The first task involved counting words in orally presented sentences taken from the Analysis of the Language of Learning (Blodgett & Cooper, 1987). Two training sentences were given to ensure that the child could perform the

task: "My name is _____. I am _____ years old." For the first training sentence, the subject was required to produce and count words in answer to the question, What is your name?, following a demonstration by the examiner, who moved one block as she said each word in the sentence. For the second training sentence, the child was required to generate a sentence following only the experimenter's oral model.

For the experimental sentences (e.g., "Eat your lunch. " "Does Jerry have a bike?" "The children were playing."), a prompt such as "Say it in a sentence" was used, if necessary. The experimenter made every attempt possible to ensure that the subject could repeat the sentences, which were initially presented slowly and clearly. If the child was unable to repeat a sentence after the first model, the child repeated the sentence a few words at a time during the second practice trial. When repetition of the sentence was established to the best of the child's ability, the subject used blocks to represent each of the words in the sentence. On occasion the child was allowed to attempt a sentence again with the prompt, "Do you want to try that again?", when the experimenter was unable to determine how the child had represented the words with the blocks.

The second day of testing consisted of two tasks that involved the manipulation of syllables. These tasks were presented in a random order. One task required that the subjects count the number of syllables in multisyllabic and monosyllabic words (e.g., *elephant, baseball, party, valentine, hat*) taken from the Auditory Skills Program (Rosner, 1975), moving a block for each syllable in order to make the task more concrete. The other task involved deleting the initial or final syllable of a word using stimuli from Rosner's (1975) Test of Auditory Analysis Skills (e.g., "Say *cowboy*; say it again but don't say *boy*"; "Say *sunshine*; say it again, but don't say *sun*"). Two examples (*helicopter, peanut butter*) were used in the training session for the syllable counting task, in which the subjects were asked to indicate the block that represented each syllable in the word and which syllable was left upon deletion.

On the final day of testing, two tasks that required the manipulation of phonemes were administered. Phonemes in consonant (C) vowel (V), VC, CVC, CCVC, and CVCC words were counted, with each sound being represented by a block (e.g., *mad, best*). For the phoneme deletion task CVCV, CVVC, CCVC, and CVCC words from the Test of Auditory Analysis Skills were used (e.g., "Say *meat*; say it again but don't say /m/." "Say *wrote*; say it again but don't say /t/." "Say *clap*; say it again but don't say /k/") in which the remaining phonemes form a real word. Again, two examples of each task were given for training (*cup, seat*).

Results

The subject's performance was analyzed first according to the unit of language that was manipulated (word, syllable, or phoneme), using a series of Wilcoxon matched-pairs signed-ranks tests. For the task in which the subjects counted words in sentences, performance was calculated in two ways: as a percentage of the number of words counted when the sentence was repeated correctly and as a percentage of the number of words counted and correctly analyzed when the sentence was different from the original stimulus due to errors in repetition. These sentences could have included omissions, substitutions, and/or additions of words. On average the subjects counted 83% of the words correctly when counting words from their revised versions of sentences but only 78% of the words from exact repetitions. Although this difference was significant, $z = 3.06$, $p < .005$, it was not a vital part of this study. Because this task was given to test the subjects' ability to analyze sentences into words, not to determine whether they could repeat more complex sentences accurately, the number of words counted from their revised versions of the stimulus sentences was considered a more accurate appraisal of their sentence analysis abilities. Therefore, further references to words counted in sentences will not necessarily include verbatim repetition of the stimulus sentence.

As can be seen in Table 1, all subjects found word counting easier than phoneme counting, $z = 3.43$, $p < .001$. The subjects also performed significantly better when counting syllables than when counting phonemes, $z = 3.15$, $p < .005$, or when deleting phonemes, $z = 3.35$, $p < .001$. No significant difference was found between the word counting and syllable manipulation tasks. However, the subjects found the phoneme deletion task significantly more difficult than the phoneme counting task, $z = 2.22$, $p < .05$.

Finally, group performance was analyzed to determine the effect of method of reading instruction, using a series of Mann-Whitney tests. The group who was receiving the code-

Table 1
Mean Percentage Correct on Language Analysis Tasks

Group	Task				
	Words in sentences	Syllable counting	Syllable deletion	Phoneme counting	Phoneme deletion
Code emphasis instruction (n = 4)	95	78	83	84	75
Whole word instruction (n = 13)	80	78	83	41	25
Total	83	78	83	51	36

emphasis approach counted significantly more phonemes correctly than did the group receiving a whole-word approach to reading instruction, $U = 3$, $z = 2.63$, $p < .01$. On the phoneme deletion task, the code-emphasis subjects performed significantly better than did the whole-word group, $U = 6$, $z = 2.30$, $p < .05$. In addition, the subjects receiving a code-emphasis approach to reading instruction counted significantly more of the words in sentences correctly than did the subjects receiving a whole-word approach to reading instruction, $U = 9$, $z = 1.96$, $p < .05$. No group difference was found on the easier syllable tasks.

Discussion

In order to better understand the possible reasons for the poor reading abilities of persons with mental retardation, it is important to study prerequisite skills for this reading task. In previous research investigators have examined comprehension, intelligence, and memory abilities of subjects with mental retardation, but not their phonological analysis skills (Stanovich, 1985). Because decoding, which is facilitated by phonemic analysis skills, is an important factor in reading (see, for example, Gough & Tunmer, 1986; Liberman et al., 1974), phonemic analysis abilities must be examined. As the evidence obtained in the present study indicates, 10- to 15-year-old persons with mental retardation are capable of performing language analysis tasks with varying degrees of success. These subjects found the syllable manipulation tasks easier and the phoneme deletion task the most difficult, in accordance with previous results with kindergarten children who do not have mental retardation (Liberman et al., 1974; Yopp, 1988).

The ability to perform explicit phonemic analysis tasks does not develop spontaneously in most normally developing kindergarten children (Liberman et al., 1974). However, when given specific instruction in word analysis at the phonemic level, they are able to learn to perform these tasks significantly better than are children who do not receive comparable training (Bradley & Bryant, 1983; Lundberg, Frost, & Petersen, 1988). In the present study, subjects who were receiving explicit, code-emphasis reading instruction (which included phoneme awareness activities, sound–symbol correspondences, and orthographic rule training using controlled vocabulary) performed better on all of the more difficult language analysis tasks than did subjects receiving whole-word reading instruction. Although all of the subjects found word and syllable analysis easier to perform than phoneme analysis tasks, the code-emphasis group performed at a consistently higher level than did the whole-word group. Taken together, the present and previous findings support both the need for explicit instruction in word analysis (Ball & Blachman, 1988; Bradley & Bryant, 1983; Lundberg et al., 1988) and the position that specific, code-emphasis reading instruction can facilitate the development of phoneme analysis and decoding skills (Tunmer & Herriman, 1984). Because decoding is a vital component of reading and is highly related to phoneme analysis ability, any instruction that can improve these skills in persons with mental retardation should be encouraged; it is through these abilities that individuals with mental retardation will be able to read and write new words and, in this way, function as independently as possible.

In conclusion, further research is warranted to learn more about the linguistic analysis skills of children with mental retardation. Younger children with mental retardation should be studied to determine when these skills begin to develop. Furthermore, we need to determine the effects of both linguistic awareness training and code-emphasis reading instruction on the abilities of larger groups of younger and older children with mental retardation. Finally, the long-term effects of this training on the reading achievement of persons with mental retardation should be evaluated.

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