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*Improving reading comprehension: Effects of sentence organization instruction**

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THIS STUDY INVESTIGATED the possibility of improving reading comprehension by training "sentence organization skills" (those that enable the reader to process sentence information in units larger than the single word). A sentence anagram task and word-grouping strategy were developed and implemented to explore the effects of training organizational skills on reading comprehension. The subjects were 31 third graders, 16 experimental and 15 control. Experimental students individually received sentence anagram training for 10 to 15 minutes 3 times a week. Results indicated that training significantly improved sentence anagram performance and transferred to reading comprehension performance. This research supports the contention that sentence organization skills are an important aspect of reading comprehension and suggests the value of instruction explicitly designed to improve reading comprehension.

Comment améliorer la compréhension de lecture: formation d'organisation de phrase

CETTE ÉTUDE A EXAMINÉ la possibilité d'améliorer la compréhension de lecture par formation de "compétence technique d'organisation des membres de phrases" (celle qui permet au lecteur de traiter l'information des phrases en unités plus grandes que le mot seul). Un travail d'anagramme de phrases et une stratégie de groupement de mots ont été développés et utilisés pour explorer les effets de compétence de formation organisationnelle pour la compréhension de la lecture. Les sujets étaient 31 élèves de cours élémentaires, dont 16 à un niveau expérimental et 15 de contrôle. Les élèves dans le groupe expérimental ont reçu individuellement une formation d'anagramme de phrases pendant 10 à 15 minutes trois fois par semaine. Les résultats ont indiqué que la formation a amélioré de façon significative l'accomplissement d'anagramme de phrases et par la même occasion celui de la compréhension de la lecture. Cette recherche soutient le débat présentant les compétences d'organisa-

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tion de phrases comme aspect important de la compréhension de lecture et suggère la valeur de l'enseignement explicitement désigné à améliorer cette même compréhension.

Mejorando comprensión de lectura: el impacto de instrucción en organizar oraciones

ESTE ESTUDIO INVESTIGÓ la posibilidad de mejorar comprensión de lectura instruyendo "la habilidad de organizar oraciones" (aquellas que permitirá al lector procesar información en unidades mayores de una palabra). Se desarrollaron y utilizaron un anagrama de oraciones y una estrategia de agrupar palabras para observar los efectos de instrucción en la habilidad de organizar con respecto a comprensión de lectura. Treinta y un alumnos del grado 3 participaron, 16 en el grupo experimental y 15 en el de control. Los alumnos del grupo experimental recibieron instrucción individual en anagramas de oración, de 10 a 15 minutos, tres veces a la semana. Los resultados indicaron que la instrucción mejoró de una manera significativa la destreza en el uso de anagramas de oración y, por transferencia, la comprensión de lectura. Este estudio declara que la habilidad de organizar oraciones es un aspecto importante en la comprensión de lectura y sugiere el valor de instrucción dirigida concretamente a la mejora de comprensión de lectura.

Background

In recent years there has been renewed interest among psychologists and educators in understanding the processes involved in reading and factors associated with reading failure. Whereas earlier studies focused primarily on word recognition and word decoding, attention is now shifting to higher level processes of comprehending and recalling written discourse and to the contribution of these processes to reading skill and skill deficiency (e.g., Adams, 1977; Pearson and Johnson, 1978; Smiley, Oakley, Worthen, Campione, and Brown, 1977; Weaver, 1978; Weaver and Dickinson, 1979). Moreover, efficient interaction or integration among various word analysis and discourse processes is considered to play an important role in overall reading skill (e.g., Frederiksen, 1979; Frederiksen and Weaver, 1979; LaBerge and Samuels, 1974; Lesgold and Perfetti, 1978; Rumelhart, 1977).

The experiment reported here focused on the effects of certain organizational or syntactic skills on reading comprehension and recall. The skill, referred to here as "sentence organization," is that which enables the reader to parse and encode information in meaningful units larger than the single word. The formation and organization of these units depends, in part, on knowledge of syntax. Many different types of studies support the positive relationship between sentence organization

skill and comprehension (Cromer, 1970; Denner, 1970; Gibbons, 1941; Oakan, Wiener, and Cromer, 1971; Resnick, 1970; Weinstein and Rabinovitch, 1971). In addition, several investigators go a step beyond establishing the relationship and suggest that instruction in these skills may improve reading comprehension (Cromer, 1970; Gibbons, 1941; Gibson and Levin, 1975; Resnick, 1970).

A survey of pertinent literature revealed that no controlled, systematic instructional investigations have been attempted in the domain of sentence organization. However, the skill has received attention in reading instructional practice (e.g., Hansen, 1963; *Phonics Is Fun*, 1970). Because of the established relationship between sentence organizational skill and reading comprehension and the suggestion for systematic instructional research, the current study was undertaken to explore the trainability of the skill and to assess its effects on reading comprehension.

A sentence construction ("sentence anagram") task and a "word grouping" strategy were developed as the central focus of an instructional experiment. The sentence anagram task involved arranging a jumbled set of words to form a sentence. The sentences increased in length from five to fifteen words. Because the task was designed to measure speed as well as power, time was restricted for each item and was related to sentence length. And because the study was based on the assumption that reading comprehension is one term used to represent more than one skill, several types of tasks were included to measure comprehension. The four reading comprehension measures were: (a) a timed sentence recognition task (time to identify the 13 sentences from a set of 26 that were false or nonsensical); (b) a cloze procedure (number of blanks replaced with actual words or synonyms in a 300 word passage); (c) a prompted sentence recall task (accuracy in verbatim recall of unrelated sentences presented in sets of five each); and (d) a passage-question subtest from an achievement test battery (accuracy in answering comprehension questions related to accompanying passages). Each comprehension task shared a different set of properties and skill requirements with the sentence anagram training task. A list of the more salient of these common properties is included here by comprehension task.

1. *Timed sentence recognition*—speed, knowledge and use of syntax, recognition of the difference between meaningful and nonsense or false sentences, and comprehension of single sentences (as opposed to connected discourse).

2. *Cloze comprehension*—sentence construction (completion

in the case of the cloze), knowledge and use of syntax, comprehension of single sentences, and knowledge of the distinction between meaningful and nonsense or false sentences.

3. *Prompted sentence recall*—efficiency and organization in short-term memory, and comprehension of single sentences.

4. *Passage-question*—comprehension of some single sentences (i.e., those questioned), and a presupposed knowledge of syntax.

Differences in the patterns of task properties and in the number of common requirements suggest that there should be different effects of sentence anagram training on performance on the various measures of comprehension. To assess this, differential transfer effects were also explored in this study.

Methodology

Design and analysis of the data

A two-factor randomized block design was used: two treatments (Experimental and Control) by two levels of reading ability (Average and Above Average). The data were analyzed in relation to several sets of questions. The first set asked whether experimental and control students and average and above average readers differed significantly on the sentence anagram posttest. The next set of questions examined whether experimental and control students and average and above average readers differed significantly on the four tests of reading comprehension taken as a group. And the last set investigated whether effects of training were reflected differentially on the four tests of reading comprehension for experimental and control students and for average and above average readers. All data were analyzed using *MULTIVARIANCE* (Finn, 1972), a packaged univariate and multivariate analysis computer program.¹ Because the numbers of observations in each cell were unequal and disproportional, the results of an unweighted means analysis are reported.

Subjects

The subjects in this study were 31 third graders attending a public school in a middle-class suburban area near Pittsburgh, Pennsylvania. The experimental and control groups were equated for sex and for reading level, as determined by existing reading grade equivalent scores. Fifteen students were classified as average readers; their reading grade equivalent scores were less than one year above the expected score (2.8) at the time of testing. These scores ranged from 2.1 to 3.6 ($M = 2.82$;

$SD = .57$). The remaining 16 students were classified as above-average readers; their reading grade equivalent scores were one year or more above the expected score at the time of testing. These scores ranged from 3.8 to 5.8 ($M = 4.45$; $SD = .60$). The average and above-average readers were divided according to sex and assigned randomly to treatment groups, 16 experimental and 15 control.

Testing procedures

Separate forms of the sentence anagram, cloze comprehension, prompted sentence recall, passage-question comprehension, and follow-the-dots tests were administered to all 31 students before and after sentence anagram training. The timed sentence recognition test was given to all 31 students during posttesting only. The sentence anagram, prompted sentence recall, and timed sentence recognition tests were administered individually; the cloze comprehension, passage-question, and follow-the-dots tests were administered to groups. To control for ordering effects, the order of administration was varied among the students. Brief descriptions of the six tests included in this study are presented next. For a more detailed discussion of the tests, reliability estimates, and procedures for administering and scoring, see Weaver (1976).

The sentence anagram test. The test consisted of 26 sentence anagrams that ranged in length from 5 to 15 words. There were four five-word and four six-word sentences and two sentences at each subsequent length. The words for each sentence were typed separately on 1 x 2 inch cards; no words (except for the pronoun *I*) were capitalized, and no punctuation was included. Vocabulary was approximately second-grade level, and the sentences were declarative and in the active voice. Each item was presented in a predetermined scrambled order, and the object was to rearrange the words to make one sentence. Maximum time allowed for each item varied from 60 to 90 seconds according to sentence length. Average time to correct solution and total number correct were recorded for each student. Average time was computed only on five- and six-word sentences. Testing continued until three consecutive items were failed.

Timed sentence recognition test. This test was a paper-pencil test and consisted of 26 grammatically correct sentences, 13 that were meaningful (e.g., *The bed was in the house*) and 13 that did not make sense or were false (e.g., *The boy who is laughing is my sister*). The object was to identify as quickly as possible all the nonsense or false sentences,

and the score was the number of seconds required to complete the test. Because speed was the variable under study, the sentences had simple vocabulary and contained propositions that were known to be comprehensible by the participating students. This test was not included in the original design of the study, but during training it seemed likely that increasing speed on the sentence anagram task would probably transfer to other reading tasks. And, although speed was a factor in some of the comprehension tests used, there was no test, except the sentence anagram test, that specifically measured speed of sentence comprehension. Therefore, this test was included in posttesting.

Cloze comprehension test. A passage of approximately 300 words was selected from a third-grade supplementary reading text (Boning, 1963) not used in the participating school. Excluding the first and last sentences of the passage, every fifth word was deleted and replaced with a blank of standard size. The students were instructed to read the passage and write in the missing words. Credit was given for supplying either the original word or synonyms of it.

Prompted sentence recall test. The test consisted of four sets of five unrelated sentences from four to fifteen words long, each set presented on a card (5 x 8 inches). The card was removed after the student read each of the five sentences aloud once. After each set, the student was asked to recall the sentences as accurately as possible. To aid recall, five prompting words (nouns in the subject or predicate position) were presented on a card (3 x 5 inches), one for each sentence, in the same order as were the sentences from which they were taken. Credit was given for the total number of sentences recalled verbatim or in paraphrase form.

Passage-question comprehension test. The elementary level reading subtest of the *Metropolitan Achievement Tests* (1970) was also used to assess transfer of training effects. Form F was used for pretesting and Form G for posttesting. The test consisted of eight paragraphs, each followed by from four to eight multiple-choice questions that assessed literal and inferential comprehension of the paragraphs. There were 45 multiple-choice items on the subtest. The score for this test was the total number of items answered correctly. The tests were administered and scored following procedures provided by the publisher (*Metropolitan Achievement Tests, Teacher's Directions*, 1970, p. 8).

Follow-the-dots test. This test was included to help account for the possible effects of the experimenter and experimental novelty. It consisted of one sample item and 23, 10 x 10 dot matrices. On each

matrix, between 20 and 26 dots were numbered randomly. The students had ten minutes to complete as many matrices as they could. Their score, then, was the number of matrices completed correctly in ten minutes.

While the experimental students received sentence anagram training, the control students remained in their classrooms and received no treatment. (Control group treatment was not possible in this study). If experimental students improved significantly over control students on the other posttests, there would be no way without such a test to separate the effects of training from those due to spending time with the experimenter in a novel situation. This particular task was chosen because it was very different from the sentence anagram task; therefore, it seemed reasonable to expect that experimental students would not improve on the follow-the-dots task from the training they received, but they might improve if they “tried harder” to please the experimenter.

Training procedures

The purpose of sentence anagram training was to teach children to solve sentence anagrams of increasing length in relatively less time by “chunking” words into higher order units. A special word-grouping strategy was devised to provide this type of training. Training was conducted with the sixteen experimental students on an individual basis. Each student was seen for approximately fifteen minutes, three times a week, and no session took place during formal classroom reading instruction.

Students were placed in the training program according to their sentence anagram pretest performance. For each student, training began with sentence anagrams that were the length of the longest correctly solved test item, where all previous items were solved correctly. Training continued until the student could solve sentence anagrams (within the time limits set for the pretest) that were five words longer than those with which training began. Posttesting began for each student between three and five days after the last training session. The mean number of sessions needed for the above average readers to complete training was 15.75 (ranging from 14 to 19); average readers required a mean of 18.12 sessions (ranging from 15 to 21). Generally, students could complete between six and ten sentence anagrams in a session.

Students were taught to use a word-grouping strategy that was designed to induce them to arrange words systematically into phrases and then to arrange the phrases into sentences. Students were taught to form word groups by first identifying the “action word,” or verb, and

then asking a series of questions to group the remaining words and to determine how the word groups are related to the verb.

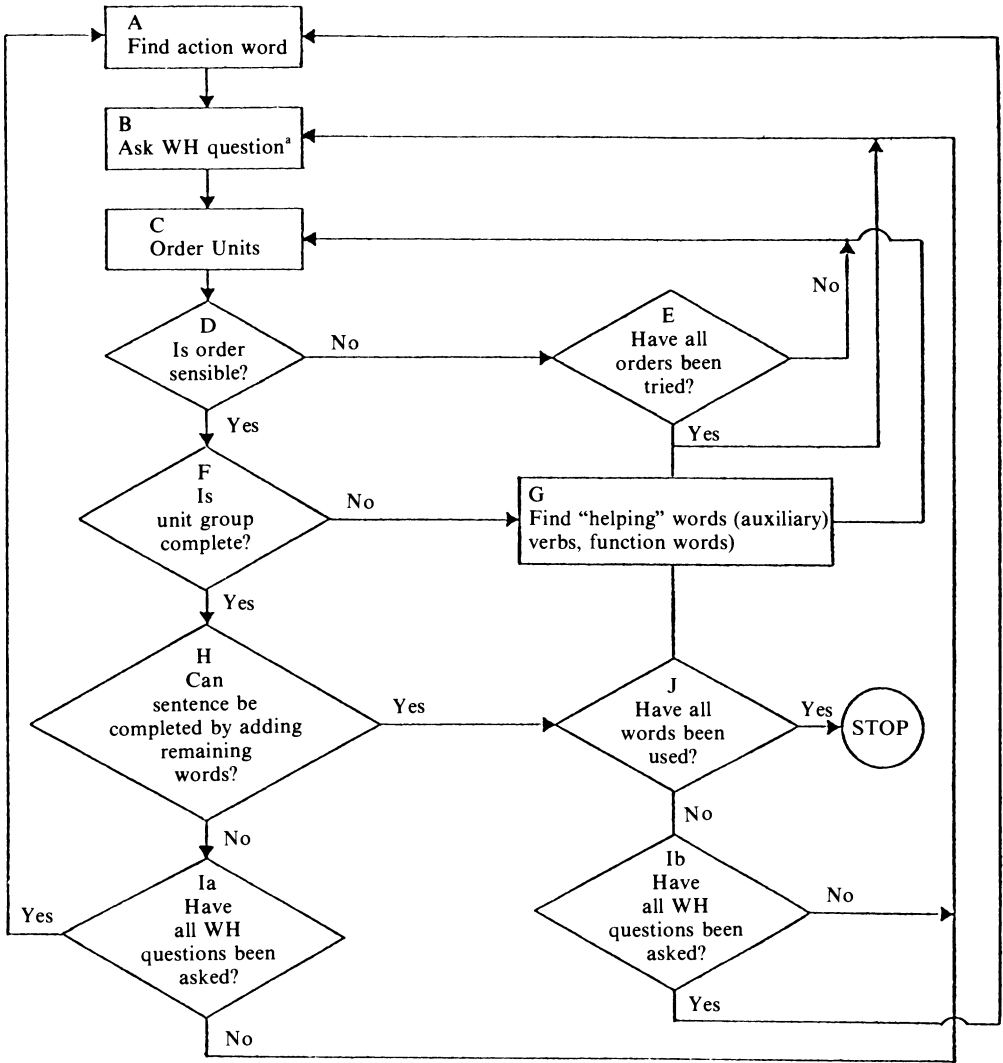
Theoretical support for the notion of forming a word group with the verb functioning as the pivot came from a model of human memory proposed by Lindsay and Norman (1972). According to their model, events in a sentence are encoded in memory by first ignoring the details and identifying the "action." The next steps are to find the "agents," "objects," and "recipients" of the action. The Lindsay and Norman model is based in part on the case grammar proposed by Fillmore (1968). Further support for the centrality of the verb in a sentence came from research by Levin, Grossman, Kaplan, and Yang (1972). They studied eye-voice span differences between reading left- and right-embedded sentences and found that for both types, most fixation time was allocated to the main verbs of the sentences.

Figure 1 shows the general structure of the word-grouping strategy devised to capture the centrality of the verb in a sentence. The strategy is useful for constructing, from a random array of words, five- to fifteen- word declarative sentences. The actions (rectangles) and decisions (diamonds) are those thought to be involved in skillful performance of the sentence anagram task. The strategy assumes knowledge of several concepts: "action word," "WH question" (e.g., Who? What? Where?), "sensibility" (i.e., Does it make sense both semantically and syntactically?), and "complete sentence." The box at the bottom left of Figure 1 presents an heuristic order in which to ask the WH questions.

The actions and decisions depicted in Figure 1 formed the basis for training. Students were taught how to perform the actions shown in the rectangles and how to monitor their actions by asking and answering the questions shown in the diamonds.

The experimenter demonstrated use of the word-grouping strategy to solve a sample sentence anagram. A simplified version of the strategy was presented in list form to establish the steps of the strategy and the order in which they were to be executed. The experimenter verbalized each action and decision (including examples of how to resolve incorrect decisions) to demonstrate the type of behavior in which the student should engage. Next, the student was asked to imitate the experimenter, who, in turn, encouraged the student to refer to the printed table, and otherwise prompted the student whenever necessary. Because the training program was individualized, the amount and type of explicit instruction varied from student to student.

Figure 1
Model of sentence anagram word-grouping strategy for declarative sentences in the active voice.



- *1. WWho?
2. WWhat? (WHom)
3. WWhere?
4. WWhen?
5. WWhy?
6. WHow?

In addition to training in the use of the word-grouping strategy, all students were exposed to other training features. These were:

1. The concepts of verb and action word, WH question, sensibility, and complete sentence were taught to each student at the beginning of training. Because the concept of a "helping verb" was found to be very difficult for most students, these auxiliary verbs were listed and made available for reference during training sessions.

2. Once a student was solving sentence anagrams of any given length by using the word-grouping strategy, a time element was introduced. Students were encouraged to decrease the time they needed to solve the sentence anagrams. Time was recorded and students were informed of their progress.

3. Once students were able to solve sentence anagrams of any given length at least 80 percent of the time within the time limits set by the pretest, sentence anagrams one word longer were introduced.

4. Vocabulary level and sentence structure of the sentence anagrams were the same for all students. The vocabulary was no higher than second-grade level; the words were chosen from first- and second-grade reading and spelling books.

Results²

Posttest analysis of variance for the number of items correct on the sentence anagram test yielded significant differences between experimental and control groups [$F(1,27) = 22.56, p < .001$] and between average and above average readers [$F(1,27) = 41.55, p < .001$]. The interaction between treatment group and reading level was not significant. Results of analysis of variance for the average number of seconds per item was significant between experimental and control groups [$F(1,27) = 5.77, p < .02$] and between average and above average readers [$F(1,27) = 16.12, p < .001$]. However, the interaction between treatment group and reading level was not significant.

Table 1 presents a summary of the means and standard deviations for experimental and control groups and average and above average readers on the sentence anagram test. These data indicate that the significant differences reported favored the experimental students and the above average readers in both accuracy and speed on the sentence anagram test.

The effects of sentence anagram training on reading comprehension were assessed using the posttest results of the four reading comprehension measures. Results of the multivariate analysis of variance revealed a significant difference between experimental and

Table 1 Means and standard deviations on the sentence anagram test for experimental and control, average and above average readers

Reading level		Experimental group (n = 16)		Control group (n = 15)		Overall M (n = 31)	
		Number correct	Average time	Number correct	Average time	Number correct	Average time
Average readers (n = 15)	M	18.38	20.98	14.00	27.53	16.33	24.03
	SD	1.77	7.33	1.92	7.83	2.87	8.04
Above average readers (n = 16)	M	22.25	13.06	19.63	17.34	20.94	15.20
	SD	1.58	4.14	2.72	5.28	2.54	5.09
Overall	M	20.31	17.02	17.00	22.09		
	SD	2.58	7.06	3.70	8.24		

Table 2 Means and standard deviations for the reading comprehension tests

Reading level	Experimental group (n = 16)		Control group (n = 15)		Overall (n = 31)	
	M	SD	M	SD	M	SD
<i>Timed sentence recognition</i>						
Average (n = 15)	18.28	3.46	19.11	3.03	18.67	3.18
Above average (n = 16)	14.21	1.58	17.46	4.11	15.84	4.03
Overall	16.24	3.94	18.23	3.62		
<i>Cloze</i>						
Average	29.50	6.14	21.43	4.58	25.73	6.72
Above average	34.63	5.13	33.00	4.84	33.81	4.89
Overall	32.06	6.07	27.60	7.51		
<i>Prompted verbatim recall</i>						
Average	12.75	1.49	10.00	3.16	11.47	2.72
Above average	13.38	2.07	9.50	2.07	11.44	2.83
Overall	13.06	1.77	9.73	2.55		
<i>Passage-question</i>						
Average	21.63	6.72	22.57	5.77	22.07	6.09
Above average	32.00	4.31	30.75	5.99	31.38	5.08
Overall	26.81	7.65	26.93	7.08		

control groups [$F(4,24) = 6.21, p < .001$]. The difference between average and above average readers was also significant [$F(4,24) = 6.31, p < .001$]; but the interaction between treatment group and reading level was not. These differences generally favored the experimental group and the above average readers. Table 2 presents the means and standard deviations on each for experimental and control groups and average and above average readers.

The results of the multivariate analysis of variance suggested a general difference between treatment groups on the set of reading comprehension tests. Discriminant analysis and univariate analysis of variance were carried out to determine which tests account for these differences. The loci of the difference between experimental and control groups appeared to be centered in the prompted sentence recall and cloze tests. Differences between experimental and control groups on the prompted sentence recall test were significant [$F(1,27) = 16.90, p < .001$], and the standardized discriminant function coefficient was quite large (.77). For the cloze test, differences were significant [$F(1,27) = 6.65, p < .02$] and the discriminant function coefficient was somewhat smaller (.57). The timed sentence recognition test and the passage-question test contribute some "weight" in discriminating between groups (.43 and .39, respectively), but the pattern of univariate F -ratios reveals that this contribution is not statistically significant.

Results of the pretest analysis on the follow-the-dots test indicated no differences between experimental and control groups or between average and above average readers. The interaction between treatment group and reading level was not significant. The posttest results similarly were not significant. Specifically, there were no significant differences between experimental and control groups or between average and above average readers. In addition, the interaction between treatment group and reading level was not significant. The means and standard deviations for pretest and posttest scores for experimental and control groups and average and above average readers are presented in Table 3.

Table 3 Means and standard deviations for the follow-the-dots pretest and posttest

		Experimental group (<i>n</i> = 16)		Control group (<i>n</i> = 15)		Overall <i>M</i> (<i>n</i> = 31)	
		Pre	Post	Pre	Post	Pre	Post
Reading level							
Average readers (<i>n</i> = 15)	<i>M</i>	9.50	12.25	10.88	13.71	10.60	12.93
	<i>SD</i>	2.56	4.62	2.53	3.30	2.72	3.99
Above average readers (<i>n</i> = 16)	<i>M</i>	11.50	15.25	11.86	13.63	11.19	14.44
	<i>SD</i>	2.88	3.69	2.48	5.76	2.64	4.75
Overall	<i>M</i>	10.50	13.75	11.33	13.67		
	<i>SD</i>	2.83	4.33	2.47	4.61		

These results showed that experimental students gained .91 points more between pre- and posttesting than control students did and that above average experimental students gained 1.98 points more than did above average control students, but these differences were not significant.

Discussion

A major purpose of this study was to determine whether sentence organization skills, as measured by performance on the sentence anagram test, are trainable. Results indicate that students who received training were significantly more accurate and faster on the sentence anagram test than were students who did not receive training. Therefore, if sentence anagram performance reflects sentence organization skills, then indeed these skills appear to be amenable to improvement by instruction.

A significant difference was also found between average and above average readers in accuracy and speed. But this is not surprising because better readers typically perform more efficiently. What is noteworthy, however, is that improvements in accuracy were significantly greater than improvements in speed among experimental students. This result is generally consistent with LaBerge and Samuels' (1974) contention that accuracy precedes speed in complex skill development. It is possible that at the time of posttesting, students had become more proficient at solving sentence anagrams but were not yet able to perform the skill at high speed. Perhaps with more practice and further refinement the experimental students might have performed the task even more rapidly.

Informal observations during training sessions suggested that providing students with feedback on time might be important in developing speed. Students were told how many seconds they were permitted for sentence anagrams of a given length, how many seconds they took to solve each one, and how each solution time compared with other times within a given session and with average times for sentence anagrams of other lengths. Students expressed a special interest in receiving this feedback, and they often set time limits that were more stringent than those set by the experimenter. This feedback seemed to be an important feature of the training program, but because all students received it, its effects on performance cannot be separated from those due to training *per se*.

When reading comprehension was measured by combining the four tests, students who received training performed significantly

better than students who did not. These results are consistent with other studies which suggest that organizational, or syntactic, skills are an important component of reading comprehension (Cromer, 1970; Cromer and Wiener, 1966; Denner, 1970; Gibbons, 1941; Weinstein and Rabinovitch, 1971), and they tentatively support suggestions that there is a need for explicit instruction and practice designed to produce higher order processing of text to improve reading comprehension (Gibson and Levin, 1975; Resnick, 1970).

The effects of training were expected to be reflected differently on the tests of reading comprehension because of differences between the skills measured by each test and the skills emphasized during training. The results of the study support the general notion of differential transfer. Effects of training transferred most to the prompted sentence recall and cloze tests, less to the timed sentence recognition test, and least to the passage-question test. Scores for average and above average readers, on the other hand, differed most on the cloze and next most on the passage-question test. The univariate analysis of variance indicated that they differed third most on the timed sentence recognition test. Finally, they did not differ appreciably on the prompted sentence recall test.

The follow-the-dots test was included to help interpret results in light of the possible effects of the experimenter and experimental novelty. Follow-the-dots is very different from sentence anagrams, so it was highly unlikely that training would improve performance on it. However, performance of experimental students might improve if, for example, they tried harder in an effort to please the experimenter. Therefore, if experimental students generally out-performed control students on posttests including follow-the-dots, results would have to be interpreted extremely cautiously in light of possible experimental effects. On the other hand, if experimental students outperformed control students on other posttests but were not significantly different on the follow-the-dots test, then results would be more likely attributable to the effects of sentence anagram training.³

Experimental students significantly outperformed control students on the sentence anagram test, the prompted sentence recall test, and the cloze test. In contrast, there were no significant treatment group differences on either the follow-the-dots pretest or posttest. These results do not rule out the possibility that there were some experimenter and experimental novelty effects—some percentage of the experimental group's superiority may be attributable to these effects. However, they do suggest that experimental group gains are due in part to the effectiveness of instructional intervention.

Instructional implications and future research

The results of this study generally support the value of instruction designed to improve reading comprehension and suggest that instruction in skills other than decoding and vocabulary may enhance the quality of reading comprehension. What generally constitutes reading comprehension instruction in the elementary grades is repeated practice in reading passages and answering various types of questions related to the passages. This form of comprehension instruction gives students an opportunity to demonstrate whether they understood what they read and it may encourage self-questioning in subsequent reading. However, it does not explicitly focus on encoding and processing the text while students are reading it. Moreover, if students do not demonstrate adequate comprehension, a typical procedure is to give them more practice in reading passages and answering questions. It is unlikely that reading comprehension of poor readers would improve substantially merely with practice. An additional, and more direct approach—carefully sequenced instruction *and* practice in those skills shown to be related to reading comprehension—may be more effective.

Although this study was conducted with a limited number of students and without a control treatment, the results suggest that sentence organization skills are related to comprehension. And, although it is not possible to determine which components of the training contributed to experimental group gains, the results are strong enough to warrant additional instructional investigation. A primary direction for such work should be to determine the most potent features of the training. For example, it would be valuable to determine whether the skills needed to solve sentence anagrams have transfer value, that is, if they can be trained in one context and will generalize to certain others. If this were the case, identifying and training these apparently more general skills might be more efficient than providing training for every set of skills that students are required to master.

Gibson and Levin (1975) suggested that certain strategies for organizing and remembering information may be important processes underlying reading skill. The organizational strategies they suggested were: focusing attention in simple decision making, systematically searching for a desired target, perceiving and using structure inherent in the material presented, and problem solving with verbal materials. The memorial strategies included rehearsing, conceptual organizing, and clustering by categorical features. Designing instructional procedures that further develop these strategies and promote their use may be an effective way to improve not only the quality of reading comprehension, but also that of other complex skills. Research is needed to determine

which skills have “high transfer value” and to which, if any, contexts these basic strategies transfer. (See Brown and Campione, 1977 for an excellent discussion of the difficulty of achieving transfer of training.)

Average readers who received training generally demonstrated the same relative degree and quality of improved performance as did the trained above average readers. However, average readers did differ from above average readers in several ways. Average readers generally required more training sessions, and as expected, they performed less well on the dependent measures than the trained above average readers. In addition, above average readers spontaneously developed and used solution strategies that average readers had to be taught to use (see Weaver, 1976). These results suggest that poorer readers may not require different instruction; instead, they may require more explicit instruction for a longer period of time. Whether these results and conclusions hold for other groups and for instruction in other skills requires additional investigation.

This study needs to be extended to different types of students. For example, an extension comparing training effects at different grade levels could be productive in tracing the acquisition and development of the organizational skills investigated here. The average readers in this study were not more than one year below their average expected reading level. Further exploration is needed to determine whether a certain level of decoding competence is prerequisite to improving organizational skills or whether training in both skills can be concomitant.

Another area of research is suggested from the results of the timed sentence recognition test. Increased speed on the sentence anagram task was not reflected on the timed sentence recognition test, and it may be the case that either speed on the sentence anagram task did not increase enough to transfer to another test or the timed sentence recognition test was not sensitive to this increase. But speed might not be a transferable skill, and this would imply that practice and feedback must be provided for each newly acquired skill. These speculations require additional experimentation.

Finally, although the results suggest the usefulness of a “zero transfer” test such as the follow-the-dots, an extension of this study that includes control group intervention is clearly needed to show conclusively that the experimental group superiority was due to training and not to the extra time spent with the experimenter in a novel situation. Furthermore, different control treatments should be compared with sentence anagram training to determine the most effective and efficient method for training organizational skills and improving reading

comprehension. Specifically, comparing (a) the more traditional training in grammar (i.e., teaching parts of speech, grammatical rules, and sentence diagramming) and (b) the more typical training in reading comprehension (i.e., giving practice in reading passages and answering questions) with (c) sentence anagram training should provide useful information for both educational researchers and classroom teachers.

Conclusions

Instructional experiments of the kind described here have many limitations. They are time consuming and costly. Also, the more the intervention resembles classroom instruction, the more difficult it is to maintain experimental control. The study described here has the added limitations of a small sample size, no control treatment, and a rather global intervention, all of which make it difficult to interpret results. Despite these general and specific limitations, instructional experimentation in reading comprehension is needed to complement basic laboratory research. The convergence of findings from these different types of investigation will enhance our understanding of comprehension and the precision of comprehension instruction.

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Footnotes

¹It is available under the name NYBMUL.

²Results of the analysis of variance on the pretest dependent measures showed no significant differences between experimental and control groups and no treatment by reading level interaction, therefore they are not included here. They are available in tabular form in Appendix G of Weaver, 1976.

³The inclusion of an expected "zero transfer" test, such as the follow-the-dots test, is useful in situations where control group intervention is impractical or impossible. This type of test can aid the interpretation of results, but it is not an adequate substitute for control group intervention.