DOCUMENT RESUME

ED 112 421 CS 202 275

AUTHOR Hughes, Theone O.
TITLE Sentence Combining: A Means of Increasing Reading Comprehension.
PUB DATE 75
NOTE 73p.

EDRS PRICE MF-$0.76 HC-$3.32 Plus Postage
DESCRIPTORS Elementary Education; Grade 7; *Learning Activities; *Reading Comprehension; Reading Games; Reading Improvement; *Reading Processes; *Reading Research; *Sentence Structure
IDENTIFIERS *Sentence Combining

ABSTRACT

The purpose of this study was to determine whether practice in transformational sentence combining will aid students' reading comprehension by giving them a large repetoire of syntactic constructions from which to draw when matching constructions contained in the materials they are expected to read. The first section of the document discusses the background of and need for the study, including the language processes (oral language, awareness of language structure, and syntactic maturity in written language) in relation to reading. Twenty-four seventh grade students were the subjects of this study, twelve for the experimental group and twelve for the control. Problems for sentence combining were constructed largely by the investigator, although in the beginning it was found that all students needed the preliminary models and exercises developed specifically for this research study. Some of the primary findings were that there appears to be a close link between a student's reading level and the same student's syntactic maturity level; that the greatest gains in reading comprehension from sentence combinings appeared to be from among the lower and middle groups of readers; and that experimental students made large gains in writing fluency. (TS)

SENTENCE COMBINING:

A MEANS OF INCREASING READING COMPREHENSION

By

Theone O. Hughes

Department of English

ACKNOWLEDGMENTS

The investigator gratefully acknowledges the invaluable efforts and expertise of the following people in making this research study possible:

Anne Ware, seventh grade teacher at the Hartford Public Schools

Patricia Wood, seventh grade practice teacher at the Otsego Public Schools and research assistant

Mary Kobreek, research assistant

Special appreciation also goes to the Hartford Public Schools and the Otsego Public Schools for their cooperation in this project, as well as to the English Department, Western Michigan University, for granting me the necessary released time to complete this study. Credit also goes to James Bosco from the Center for Educational Research and to Samuel Anema, Computer Center Consultant, for their helpful advice on the handling of statistical data, and to my colleague Constance Weaver for her careful reading of, and helpful comments on, the manuscript.

SENTENCE COMBINING: A MEANS OF INCREASING READING COMPREHENSION*

THEONE HUGHES
Western Michigan University

This study examined transformational sentence combining (embedding one sentence into another) as a means of enhancing reading comprehension through increased syntactic fluency.

A large body of research supports close interrelationships among language processes and suggests awareness of larger linguistic units (phrases and clauses) as separating better readers from poorer readers. Sentence combining has shown promise as a means for increasing this awareness.

A t-test for correlated samples was constructed using cloze scores from seventh grade classes in two schools for the initial pairing. Miscue analysis, as well as cloze, was used to indicate changes in knowledge of grammatical relations and in reading comprehension, and Gates-MacGinitie tests for speed and accuracy were given to determine whether larger "chunking" of linguistic structures would result in greater speed as well as in more accurate predicting.

Miscue analysis showed positive findings for grammatical relations at the .01 level of confidence with most of the improvement resulting from the lower half of the experimental classes. Students poor in reading were also those requiring prolonged teacher assistance in sentence combining. Reading comprehension lagged behind knowledge of grammatical relations in miscue analysis, with each school showing a large trend towards increased comprehension by the experimental groups, but a nonsignificant one. On the basis of the combined scores, however, significance was reached at the .05 level. Cloze procedure also showed a trend towards positive results, but it was nonsignificant. This was also true for the Gates-MacGinitie speed and accuracy tests. It was hypothesized that sentence combining removed syntactic roadblocks in reading comprehension, but that this removal did not always result in increased comprehension.

A secondary purpose of establishing correlations between reading scores and syntactic maturity norms based on Hunt's prototypes (Hunt, 1970) was also largely confirmed.

---

*This research was supported in part by a Faculty Research Grant, Western Michigan University.

BACKGROUND AND NEED FOR THE STUDY

Reading has always occupied a central position in American education. In spite of this emphasis, however, one out of every four students nation-wide has significant reading deficiencies, according to a recent report quoted by Bormuth (1973-1974). In the same report, up to half of the students in large city schools were cited as reading below expectations. Children, too, are aware of the significance of reading as a yardstick of their success or failure, judging their ability to read in relation to their peers' ability as an infallible predictor of their academic future. The literature abounds with studies on the interrelationship between reading ability and self concept.

The literature also abounds on the close interrelationships between reading and the other language processes. Recent studies based on newer knowledge from psycholinguistics shed particular light on these close interrelationships. Is there, then, a link between the acquisition and development of language, either spoken or written, that provides a key to unlocking the written code in reading? This research study aims to reveal such a key. After all, children almost universally learn to speak without formal training, and speaking and reading are both language processes. Some children even teach themselves to read without formal training. Moffett (1973) suggests that if more children do not learn to read without formal phonics training, it may well be because they have not been presented with enough language about which to generalize (p. 12). As Moffett suggests and this research aims to show, generalizations about language may be at least part of the answer to increased reading ability. For purposes of analyses, the language processes will be considered separately as each relates to the reading process.

ORAL LANGUAGE AND READING

What is the link between the acquisition and development of the spoken language which can provide a key to the unlocking of the written code? Loban (1969) found a correlation between those showing achievement in reading and those exhibiting fluency in speaking. Strickland (1962) had earlier found that a close relationship existed between general language ability and reading ability. Milner (1951) discovered, even earlier, that first grade reading achievement linked closely with the enrichment of the verbal environment of the home. Newman (1972) has shown that first grade reading achievement is a significant and strong predictor of sixth grade reading achievement and a more reliable measure of later reading success than are first grade readiness scores. Walter Loban's work, in particular, has illuminated the link between oral language and reading. In addition to the work cited, Loban (1963) reported finding significant relationships between children's reading and listening comprehension achievement and their ability to use movables and subordination in oral language. Later, as an outgrowth of this thirteen-year longitudinal study of 211 children's syntax from grades K-12, Loban (1970) confirmed and extended his earlier findings. Differences between high and low ability groups stayed, consistently throughout school, about five grades apart on syntactic maturity measures: words per T-unit,* repertoire of syntactic structures, use of subordinators, use of movables (largely transformations reduced to phrases--gerund, participial, appositive, etc.), as well as clarity in writing, and reading achievement. For example,

*A T-unit, or minimal terminable unit, is defined by Hunt as a main clause plus any subordinate clauses or nonclausal structures attached to or embedded in it. (See Hunt, 1970; p. 4)

not until grade five does the low group from grade one catch up to the high group's words per communication unit (roughly equivalent to Hunt's T-unit). That is, the high group's 7.91 average in words per communication unit in grade one was not reached by the low group until grade five. From the consistency of his findings on all language factors, Loban suggested that he might soon be able to predict language performance in high school from language behavior in the early grades.

The evidence, then, suggests that there is a close relationship between fluency in oral language and reading and that this relationship lies in the speaker's or reader's ability to use embedding transformations, particularly those that have been reduced to movables. In other words, syntactic maturity may be the link between oral language and reading that has been so well documented.

AWARENESS OF LANGUAGE STRUCTURE AND READING

If awareness of language structure, or syntactic maturity, is a component for predicting success in reading and begins early with the transition from oral to written language, then this factor should be identifiable in the early grades. Such seems to be the case. MacKinnon (1959) found, in a very detailed study of beginning readers, that they attempted to substitute syntactic patterns that they knew for unfamiliar patterns. Gibbons (1941), using a "disarranged phrase test," found a high correlation (.89) in third grade children's ability to understand the structure of sentences and their reading achievement. Ruddell (1965) found that reading comprehension scores of fourth graders on materials using high frequency language patterns were significantly higher than scores on

materials using low frequency language patterns, in both cases with variables of vocabulary, sentence length, subject matter, etc., controlled. In a longitudinal study, Ruddell (1966, 1968) has demonstrated that the sentence and paragraph meaning comprehension of first and second grade children can be significantly enhanced by emphasizing the meaning relationships between key structural elements within and between sentences. Weber (1970) found that both high and low groups of readers in first grade used grammatical cues. She also found that the mean graphic similarity for substitution errors by the high group was appreciably greater than for the low group, showing greater sensitivity by better readers to graphic cues. However, what differentiated the two groups was sensitivity to errors that upset the grammar. The high group failed to correct only 15 percent of errors that upset grammaticality, while the less efficient readers ignored 58 percent. Weber also found that grammatically unacceptable responses shared more graphic features with the stimulus words than did grammatically acceptable errors. The inverse relationship suggested that when children neglected the constraints of the preceding grammatical context in their reading, they were attending to the task of identifying the features of the graphic display. Goodman (1973), in his impressive research study, found that on the basis of all reading miscues (mismatch between reader and text), the better readers in grades 2 and 4 showed positive correlates between comprehending and graphic and phonemic proximity, a very similar finding to Weber's when all miscues were considered. However, by grades six, eight, and ten, the situation reversed (p. 74). Looking at the low readers in grade six, he notes that "their preoccupation with the graphic phonemic cueing system is overwhelming." (p. 234)

Frank Smith (1975 gives some reasons why miscues showing high graphic similarity may correlate negatively with grammatically acceptable miscues, as well as correlate negatively with efficient reading. According to him,

the efficient reader seeks just enough information to decide among the alternatives, rather than slog "through thickets of meaningless letters and words in the fond hope that eventually some nugget of comprehension will arise." (p. 309) As he demonstrates earlier, "There is a trade-off between visual and non-visual information in reading--the more that is already known 'behind the eyeball,' the less visual information is required to identify a letter, a word, or a meaning from the text." (p. 7) Just as high numbers of graphic miscues indicate inefficient reading, particularly in the older grades, high numbers of syntactic and semantic miscues indicate efficient reading. Clearly some close links exist between reading proficiency and knowledge of syntax, i.e., with what is 'behind the eyeball.'

SYNTACTIC MATURITY IN WRITTEN LANGUAGE AND READING

There is ample evidence, then, that sensitivity to grammatical relations is a characteristic of the better reader. There is also evidence that fluency in oral language is a predictor of fluency in reading, and the ability to use transformational embeddings, especially those reduced to movables, is one descriptor of this fluency. Is there also a link between those exhibiting syntactic maturity in their writing and fluency in reading? Loban (1963, 1969, 1970) has noted in all of his studies of the language maturing process that reading achievement and effectiveness in writing were characteristics of the high group with the largest repertoires of syntactic structures. What is not made explicit is whether reading achievement and writing effectiveness are the results of

greater syntactic development or the effect of some other causal factor which also facilitates the use of embedding transformations and the accumulation of a larger storehouse of syntactic structures. Is there a link between syntactic maturity in writing and fluency in reading, the analysis of which can illuminate the facilitating factors for reading? There appears to be this link also, as this study is designed to demonstrate.

Kellogg Hunt, in an early study (1965), developed some objective measurements for determining syntactic maturity, one of which was the T-unit, discussed earlier. In this study he found that mean words per T-unit was the best indicator of syntactic maturity, followed closely by clause length, number of clauses, and then by sentence length. In his later study (1970), although largely confirming his earlier findings, he noted that clause length was a better indicator of syntactic maturity than mean words per T-unit, and that embeddings per clause was even better than clause length. In this study he controlled the subject matter for writing by using a group of very simple sentences on an expository subject (aluminum), rather than use free writing in which subject matter is not controlled. The 36 sentences in the Aluminum instrument, developed by Dr. Roy C. O'Donnell, were administered to a thousand students in grades 4, 6, 8, 10, and 12 in the public schools of Tallahassee, Florida. In addition, it was also given to two groups of adults, one of which was average, and one of which could appropriately be considered skilled. The conclusion of his study shows that as children mature mentally they "tend to embed more of their elementary sentences, their kernel strings." (1970; p. 58) Not only do they use a wider variety of transformations, but they reduce

more inputs to less than a predicate. Hunt, in exploring the psychological and behavioral reasons for this trend, dismissed imitation of adult conventions, although he acknowledges that the deletion of redundancy increased succintness. He also dismissed "having more to say," since the amount that any of the subjects could say was controlled by the instrument itself. "A more attractive explanation," he found is that "as the mind matures it organizes information more intricately and so can produce and receive more intricately organized sentences." (p. 58) He gives support for this notion by citing Miller's (1956) theory of 'chunking.' In Miller's now famous study he suggests that the number of chunks of information that the human mind can perceive, process, and remember is roughly seven, plus or minus two. Since this number is fixed by short-term memory, a way around the limitations of this span is to recode bits of information into larger chunks and rename the chunks. Hunt sees the recursive S of transformational grammar as a means of recoding the smaller bits of information found in the simple sentences into larger chunks dominated by fewer nodes. "One can scarcely escape the conclusion that as writers mature they take advantage of more and more opportunities for consolidating sentences." (p. 53)

Mellon (1969) conducted a study with 250 seventh grade students over the period of one academic year in which the experimental groups devoted one-third of their English class time to sentence combining activities plus one hour per week of out-of-class time. His experimental group at the end of that time had made significant increases on all dependent variables of syntactic maturity, including clause length, words per T-unit, depth of

embedding, number of nominal and relative clauses and phrases, and subordination-coordination ratio. These gains exceeded both those of the control group and placebo group at or above the .01 level of confidence.

Because Mellon's study used transformational terminology as well as some formal grammar study, Frank O'Hare questioned whether the impressive gains were a reflection of increased knowledge about grammar or were directly due to the sentence combining exercises. Using 95 percent of Mellon's sentences, but omitting transformational terminology, O'Hare (1973) largely replicated the Mellon study, using 41 seventh grade students in the experimental group and 42 seventh grade students in the control. His experimental students also made impressive gains over those of the controls, forcing him to conclude that sentence combining was the process which made possible the large increases in syntactic maturity in students' writing.

A study into the relationship between children's performance in written language and their reading ability was made by Evanechko and others (1974), using measures from transformational grammar and other measures, i.e., the Botel & Granowsky measurement for syntactic complexity (1972). The subjects were 118 sixth grade children from four classrooms in one school in Victoria, British Columbia. They concluded that reading ability was indicated by two closely associated factors: number of communication units, i.e., more to say, and control of syntactic complexity as indicated by more of what they called Two Count Structures, largely embedding transformations. The presence of these two factors brings up an interesting speculation. Are they interrelated? Miller and Ney (1967) noted that sentence combining "enabled students to write a greater

amount of prose in a specified time." (p. 54) Later, in constructing a psycholinguistic model of the writing process, Ney (1974) notes that practice in transformational sentence combining not only enables students to write with greater syntactic maturity, but also with increased perception and use of detail. He hypothesizes that sentence combining "calls the attention of the student to some innate linguistic resources. The students then begin to use these resources as they are called to their conscious attention." (p.168) O'Hare (1973; p. 72) attributes the facilitating effect to confidence gained from released syntactic roadblocks and the ability to see a wider variety of syntactic alternatives. Sentence combining, then, seems to create both a central effect of greater syntactic maturity, and a peripheral effect of greater fluency. In support of this position, O'Hare notes that although adverb clauses were not specifically taught, the experimental group produced "a significantly greater number of adverb clauses in their free writing. (O'Hare, 1973; 72) If sentence combining can remove syntactic roadblocks in writing, it would seem logical that the same process would operate in reading, with students freed to attend more closely to meaning.

Since it is possible through sentence combining to increase syntactic maturity in writing, will this maturity be reflected in oral language, long noted as closely correlated with reading? If so, then practice in the transformational embedding process seems even more promising as a possible tool for improving reading. Such also seems to be the case. A few studies will be mentioned briefly in support of this position. Hunt (1964;1965) found a close parallel between children's free writing

and their oral language on the objective measures he had found to be sensitive predictors of language maturity. O'Donnell and others (1967) extended Hunt's findings by controlling the variables of subject matter and situation and found that the same determiners for syntactic maturity were operative in both oral and written language. The work of Miller and Ney at about the same time (1966, 1967) showed similar findings. The latter study, however, followed a different methodology, using foreign language techniques of oral practice in sentence combining from models written on the blackboard. These were followed up later in the year with written practice. From the models of sentences used, experimental students made significant gains in multi-clause T-units. Later, Burruel, Gomeyz and Ney (1975) repeated the Miller and Ney experiments using bilingual children from a barrio school and achieved similar results.

Children's ability to combine more and more of their elementary sentences, as well as delete those elements which become redundant in consolidation, appears to be the language maturing factor at the heart of all the language processes. Since sentence combining practice can facilitate language growth, it seems like a logical tool for increasing reading comprehension.

"CHUNKING" AND THE FLUENT READER

Some related studies also shed light on sentence combining as a means of increasing reading comprehension. These suggest that the more efficient readers read to phrase and clause boundaries, i.e., chunk material for ease of storage in short term memory. Since sentence combining is a means of recoding smaller bits of less information-bearing pieces (letters and words) into larger chunks or patterns carrying more meaning (phrases or clauses), these investigations should be discussed here.

A particularly impressive research study was done by Blanton (1968) on the Tennessee deaf. Memory for sequence among the deaf is reduced because of less skill in the perception of temporal ordinality. Since spoken language is sequentially ordered, the hearing child can usually learn to chunk written material so that it corresponds to already learned phrases and clauses. After having words presented visually to them on a screen, the Tennessee deaf showed remarkable word recall, equal to the best of the hearing children. However, for the deaf this recall was independent of the order in which the words were presented: phrases, nonphrases (grocery lists, etc.), or scrambled phrases. The hearing children in the experiment, however, who were reading at least five grades above the children who were deaf, had great difficulty remembering words except when the material was presented to them in phrases. Clearly, the ability to recognize words was of far less significance for recall than the ability to chunk words into meaningful units. It would certainly seem that syntax is a determiner of language comprehension. If word recognition were all that were needed, the deaf would be reading at the same level as hearing children, or above. As Vygotsky (1972) has stated, "A word in a context means both more and less than the same word in isolation: more, because it acquires new content; less, because its meaning is limited and narrowed by the context....Just as the sense of a word is connected with the whole word, and not with its single sounds, the sense of a sentence is connected with the whole sentence, and not with its individual words." (p. 146). Meaning, then, is in large part syntactic.

Support for the assumption that recognition of words is of lesser importance than awareness of syntax comes from a study by Oakan and others

who assessed the relationship of identification and organization to comprehension for both good and poor readers, aged 9.10 to 11.3 years. Identification training (prior training in identifying each word before the reader encountered it in the text) made no difference for the poor readers. When visual organization was disrupted, the good readers suffered more than poor readers. The researchers concluded that an appreciable amount of difficulty of poor readers may be in organization of input rather than in recognition. A similar conclusion was reached from a study by Weinstein and Rabinovitch (1971), who found that structure alone was the facilitating factor for good readers but had little or no effect on the poor readers, although both good and poor readers had scored equally well on a paired-associate task of learning, and I.Q. had been partialed out. Frank Smith (1975) has made a persuasive case for the fact that words, including the most common ones in children's language, have many meanings, including syntactic ones, and therefore cannot be identified without reference to syntax. He states that a word like house, for example, cannot be understood or even articulated until the reader knows whether it is functioning syntactically as a verb or a noun (p. 305).

For some time EVS (eye-voice span) has been used as a measure of the influence of syntactic structure upon reading (Levin and Turner, 1968; Levin and Kaplan, 1970). The eye-voice span is the number of words which the eye is ahead of the voice in oral reading. It is closely associated with short term memory. Since short term memory can hold approximately five to seven units (letter, words, phrases, or clauses), according to Miller (1956) and Simon (1974), EVS is a good measure of reading efficiency. That is, the reader who recodes or chunks information puts less burden on

short term memory and thereby increases comprehension. Poulton (1962), in working with peripheral vision and reading, claims that word recognition suffers when less than two words are visible at once. Levin and Kaplan (1970) studied subjects at six grade levels, ten for each grade, measuring eye-voice span. Their findings were that older subjects had longer EVS's than younger subjects, and that faster readers had longer EVS's than slower readers. They also found "that the EVS tended to extend to a phrase boundary. This tendency was not related to the age of the reader (except in the second-grade sample) nor to the phrase size (p. 124)." Rōde(1974-1975) investigated children's ability to decode phrases and clauses at three developmental levels, third, fourth, and fifth grades, using 54 children in all (18 in each group). Forty-eight target sentences were used to measure the eye-voice span with six possible critical light-out positions for each paragraph. Her findings were that older children attempted to decode or 'chunk' a unit of meaning which was a clause rather than a phrase, while the youngest read more to phrase boundaries. When corrected scoring was used, rather than errorless scoring, and qualitatively good miscues (those not disrupting syntax or meaning, using the Goodman and Burke (1972) measures for determining qualitative differences), then children attempted to read to clause boundaries, from youngest to oldest.

Two more experiments in the perception of phrase structure in written language chould be mentioned. A study by Anglin and Miller (1968) using recall as the dependent variable found that subjects were able to recall paragraphs segmented by phrases (each phrase kept intact on a line) significantly better than by nonphrase (passages segmented so that a part of a phrase extended to the following line). All subjects were adult competent readers, who acted also as their own controls. The

researchers interpreted their results "as supporting the psychological validity of phrase structure. We assume that, in order to read and remember the passages, Ss must grasp the grammatical structure of the sentences they contain." (p. 344) Graf and Torrey (1966) examined the assumption that if words are grouped into major linguistic units rather than in nonphrase groupings, then comprehension in reading would be significantly improved. Major and minor boundaries were determined by constituent analysis. Phrase segmentation selections maintained the major units (phrase, clause, or sentence) together on one line, while antiphrase selections allowed a portion of such units to extend to another line, i.e., separation at minor boundaries. The thirty-two undergraduate volunteers were given passages arranged in both ways, followed by an eight-question multiple-choice quiz. The greater comprehension for the phrase segmentation over the antiphrase arrangement was significant at the .01 level of confidence. Their conclusion supports the mounting evidence that although length of EVS is an important indicator for reading achievement, what is more important is that the span incorporate a genuine linguistic unit and not just four or five words.

Practice in clause consolidation as a means of widening EVS to incorporate genuine linguistic units, i.e., phrases and clauses, seems promising indeed, since these larger units are largely the results of embedding and deletion processes. Practice in creating these phrases and clauses would seem to give the reader prior expectations and dispositions to perceive these larger meaning-bearing units. It should also

help them find the organizing principles that make comprehension in reading possible. As Kellogg Hunt (1970) concluded upon finding consistent syntactic growth by school children in words per T-unit, embeddings per T-unit, clause length, and deletions to less than predicates:

> All this has implications for the teaching of reading in the early grades. Teachers need to be trained in clause-consolidation so that children can be taught what otherwise they must discover unaided.
>
> Here is another place where the results of research should crawl out of the learned journals and into the classroom (p. 200."

PURPOSE OF THIS STUDY

This study is based on the abundant evidence from psycholinguistics that reading is an active process of predicting and reconstructing what an author is going to say and sampling for verification, "a psycholinguistic guessing game(Goodman, 1967)." The purpose of this study is to determine whether practice in transformational sentence combining will aid students' reading comprehension by giving them a larger repertoire of syntactic constructions from which to draw in matching those contained in the materials they are expected to read. The study is predicated on ample evidence that EVS widens with efficient reading and with more structured material and narrows with inefficient reading and less structured material. It is also predicated on the numerous studies which show that efficient readers "chunk" material into larger linguistic units, reading to phrase and clause boundaries, while less efficient readers do not. Since the capacity of short-term memory can hold approximately the same number of units, whether these are letters, words, phrases, clauses, or sentences (Miller, 1956; Simon, 1974), then any patterning into these larger units, i.e., chunking, should minimize the burden on memory and increase comprehension. The facilitating effect of structure is easy to demonstrate by trying to remember a sequence like 20, 5, 25, 15, 10 vs. 5, 10, 15, 20, 25. As Smith (1971) states, "Syntax is the arrow between visual information and meaning identification (p. 222)." That is, the reader's need for gathering larger quantities of the smaller and less information-bearing pieces of graphic cues which burden short-term memory should be lessened by practicing ways of recoding these into larger units of phrases and clauses--the chunks often resulting from the transformational embedding process. The increased comprehension facilitated by structure may come, as Forster (1966) proposes, from the fact that word order does not have to be stored in short-term memory, as was demonstrated in the patterned example (5, 10, 15...).

A number of comprehensive models of the reading process have been developed recently, a few of which have taken advantage of the newer knowledge of psycholinguistics. An attractive model for the fluent reader, which this study seeks to validate (or invalidate) is The Reading Competency Model posited by Venezky and Calfee (1970), which suggests that "essential processes are high speed visual scanning, dual processing, and a search for the LMU (largest manageable unit), (p. 273)." Ways in which this research project examine the predictive powers of this model are:

a) High speed visual scanning. Sentence combining should speed up the visual process by increasing students' familiarity with the phrases and clauses resulting from the embedding process. That is, it should help them chunk or reorder smaller units (letters and words) into larger perceptual units (phrases and clauses), thereby eliminating the time-consuming process of attending to every letter or word. For example, if reading proceeded on a letter-by-letter basis, its maximum rate would be three or four letters per second, or between thirty and forty-two words per minute, using the average for English words of five to six letters in length (Smith, 1973; p. 31). Therefore, experimental students practicing sentence combining should show an increase in reading speed as compared to control students.

b) Search for the LMU. Students should become aware of the phrases and clauses which result from the embedding processes by performing clause consolidation. That is, by producing (encoding) these larger units, they should more readily perceive them as perceptual units related to deep structure (decode them) in their reading. Some indication of this

greater awareness of words as parts of larger units would be an increase in the experimental students' scores on miscue inventories for grammatical relationships over those of the control subjects.

c) Syntactic-semantic integration (a part of the "dual processing") In the Venezky and Calfee model, the term "dual processing" means two forms of processing happening simultaneously: (1) syntactic-semantic integration of what has just been scanned, and (2) forward scanning to locate the next LMU. Since "Search for the LMU" is handled separately, only syntactic-semantic integration will be considered here. What seems to be important in testing the model's predictive powers is the preservation of the essential processes, keeping them sufficiently distinct so that they can be analyzed. That is, although the model shows these processes occuring together, it does not seem to follow that they must also be analyzed together. In fact, the model is more amenable to analysis by considering them separately. In addition, the search for the LMU subsumes syntactic-semantic integration, for how else would the largest manageable unit be recognized?

Syntactic-semantic integration in itself contains a duality posited in transformational theory, the duality of recognizing deep structure in surface structure. According to Fodor, Bever, and Garrett (1974) in their study of sentence perception, "the essential problem about sentence recognition at the syntactic level is to account for the recovery of deep structure." (p. 328) This includes the recognition of what parts of the surface string belong to the same deep structure sentoid*, and

*Fodor, Bever, and Garrett (1974) define a sentoid as a subtree of the base structure "whose highest node is S and which contains no embedded sentences." (p. 328)

also the relationship between these sentoids. They support their theory by showing evidence that readers, in order to comprehend, group together the surface items belonging to a single sentiod, i.e., organize them into perceptual units. For example, in order to recognize the sentence "Mary believes the child is ill," the reader must recognize the surface clause boundary between "Mary believes" and "the child is ill" as reflecting a deep structure boundary between two sentoids. In addition, the reader must recognize that the sentoid containing "Mary believes" dominates the sentoid containing "the child is ill." They give considerable evidence (Pp. 329-344) to support the theory that the clause is the major unit into which verbal material is rechunked and that surface structure clauses are important mainly insofar as they signal deep structure clauses. As we saw earlier, even young readers attempt to read to surface clause boundaries (Rode, 1974-1975), suggesting their awareness of these as perceptual boundaries.

It would seem that practice in sentence combining (consolidating simple kernel sentences by embedding one into another), as well as practice in reducing the clauses resulting from this process in the surface structure to phrases or single words, should, in a sense, wear a path between deep and surface structure that could be traveled in either direction. This practice should make students more aware of the several surface representations possible from the same deep structure, making possible syntactic-semantic integration of what has been scanned. Experimental students' comprehension scores should reflect greater gains in comprehension than those of control students, because comprehension of deep structure should be more quickly retrievable from surface structure in this dual process of syntactic-semantic integration.

There is a need for research which can compare and validate the predictive and explanatory powers of some of the comprehensive models being offered, as Kenneth Goodman (1973; p. 9) suggests. A central aim of this study is to examine the predictive powers of the Venezky and Calfee model for the fluent reader.

An additional aim of this study is to check the validity of the assumption that there is a direct relationship between students' reading scores and those same students' levels on a scale for syntactic maturity, using Hunt's prototypes (grade-level norms), established by the Aluminum instrument (Hunt, 1970). Loban's findings of a five-year lag in syntactic maturity in the low language group as compared with the high group at any grade level (Loban, 1970; p. 627), together with his observation that reading scores were closely correlated, could be tested with normative data, using the same instrument Hunt used in securing those norms. If such a validation does occur, it seems reasonable to expect that those students on the lower ranges of the syntactic maturity scale will derive most in reading comprehension from sentence combining. For these students it should provide a means of catching up to the higher language group who are already making adequate use of syntactic cues and of syntax as a part of meaning. As Vygotsky (1972) has noted: "One grammatical detail may, on occasion, change the whole purport of what is said." (P. 128) Being able to catch more of these grammatical details should, therefore, help these poorer readers to understand more of what they read.

RELATED RESEARCH

Although there have been a number of studies which show a relationship between awareness of grammatical constraints and the ability to read, as noted earlier, most of these have been conducted with beginning readers and and without the insights which transformational or psycholinguistic theory brings to the knowledge of reading. This study uses older students (seventh graders), who are old enough to be developmentally ready to use a wide variety of transformational embedding operations even though they may not be doing so. Ney (1974) has clearly demonstrated that error rate in sentence combining depends upon the students' developmental stage. For types of sentence combining for which the students are too young to be developmentally ready, even numerous practice sessions may still result in a high error rate of, for example, 60%. For those forms for which the students are developmentally ready, sometimes only one practice session is needed to bring the error rate to nearly zero, perhaps to as little as 4%. Older students, then, would provide a different population than is most often used. In addition, they would minimize the problem of developmental readiness as a factor.

The use of clause consolidation as a means of increasing reading comprehension has not been mentioned in any of the summaries of investigations relating to reading this investigator has read. Nila Banton Smith (1971) mentions no such studies, and no related research is mentioned in the several summaries conducted by Samuel Weintraub and others (Winter 1972; Spring 1973; 1973-1974; 1974-1975). However, three recent studies, two

of which are unpublished doctoral dissertations, have used sentence combining as a means of improving reading.

O'Donnell and King (1974) investigated sentence combining and sentence decomposition with 50 seventh grade students in three separate English classes in two schools. All but two of the students were below the twentieth percentile in reading comprehension and 39 of them were below the tenth percentile. Approximately the same number of students drawn from the sixth, seventh, and eighth grades were used as "norms." Unfortunately, the results were disappointing. The authors surmise that failure was due to both psychological and academic factors: the low academic achievement record of the seventh-grade subjects, their severe reading retardation, and their hostility for being singled out for what they thought to be their inability to learn in the regular classroom, together with the relative sophistication of the tasks required of them.

O'Donnell and King, however, believe there is promise in both the composing and the decomposing process and suggest that simpler materials or less severely retarded subjects might well yield very different results.

In his doctoral dissertation, Fisher (1973) investigated whether exercises in sentence combining could improve the reading and writing of 94 students in fifth, seventh, and ninth grades. Cloze pretests and posttests and standardized reading tests were used to measure reading comprehension gains. Sentence combining exercises were administered for approximately 20-30 minutes per day for five weeks. Towards the end of the time, sentence decomposition was also taught. Using Hunt's measures for

syntactic maturity (words per T-unit, clause length, and number of clauses per T-unit), an analysis of the students' writing was also made. Findings showed that experimental students were significantly higher on writing output and maturity of writing. All experimental subjects also scored significantly higher on reading output, i.e., they read more." On reading comprehension, however, only fourth grade experimental students showed significant gains over those of the controls. The mixed results for reading comprehension brings up unanswered questions. Was the time span of five weeks with only 20-30 minutes per day sufficient? Based on a five-day school week, the total time of exposure to the treatment was approximately 10-12 1/2 hours, which seems slight. Another question arising is whether greater comprehension might have resulted if only those least syntactically mature of the older groups had been tested. For writing, the evidence suggests that gains in syntactic maturity and fluency are made across ability levels through high school. However, for reading the gains may be largely for those students least syntactically mature. More research is needed in this area.

An unpublished doctoral dissertation by Stedman (1971) used sentence combining exercises for the purpose of determining reading comprehension with groups of black and white fourth graders. Cloze tests were used for testing reading comprehension. However, instead of the usual nth word deletion, the omissions were largely of structure words--those contributing chiefly syntactic meaning to sentences: prepositions, conjunctions, modals, relative and interrogative pronouns, etc.--along with some words carrying semantic meaning (nouns, verbs, adjectives, adverbs). Treatment extended for one school year and materials on

which cloze tests were based included the transformations that were part of the treatment. Findings were positive, with the results for all experimental students showing gains significant at the .05 level. When scores for black students and white students were separated, the gains were found to be largely made by black students. These experimental students showed gains at the .01 level of confidence. For white students, however, the gains were nonsignificant. The hypothesis was advanced that the white students were largely knowledgeable of the syntactic structures which the blacks had not had opportunities for acquiring.

PRELIMINARY STUDY AND FINDINGS

A secondary aim of this study, preliminary to the study itself, involves checking the validity of the assumption that there is a direct relationship between students' reading scores and those same students' levels on a scale for syntactic maturity, using Hunt's normative data (Hunt, 1970). That is, improving students' syntactic maturity through sentence combining in order to improve their reading comprehension, the main thrust of the study, presumes that a close relationship exists between language ability and reading comprehension. Since the main study relies on this assumption, validating or invalidating this preliminary premise provides an empirical framework within which to examine the study itself. Therefore, this part of the study is handled preliminary to the study itself.

After students at the Hartford School were separated by cloze procedure, using every fifth word deletion (See "Statistical Methods" for more detail), they were administered Hunt's Aluminum instrument (Hunt, 1970). As Hunt has expressed it in his monograph, "The instrument used here as a research instrument has obvious uses for the measurement of syntactic maturity in new populations." (Hunt, 1970; p. 59) Since it was outside the bounds of this study to examine all data from the sentence combining of the Aluminum paragraph, the following procedure was adopted. Random samples from each reading ability level (high, middle, and low), based on cloze scores, were selected. Although they were selected at random from each reading ability level, they appear to be highly representative of the others from that same level. The results match very closely Hunt's syntactic maturity norms. Hunt's norms for seventh graders were computed

by taking those for sixth and eighth grades at each level and averaging them (Hunt, 1970; p. 17). As can be seen below and in Figures 1 and 2, the comparison between reading levels measured by cloze procedure match very closely syntactic maturity levels established by Hunt's norms. (In each case, the kernel sentences from the Aluminum passage appear directly below the student's sentences shown in Figures 1 and 2.)

Student A (See Figure 1), a reader from the high group, combined 32 of the kernels into 11 of her sentences, almost a 3 to 1 embedding ratio. On words per T-unit (109 words divided by 11 T-units), she achieved a 9.64 words per T-unit. Hunt's computed norm for the high group at seventh grade is 9.56, an extremely close comparison.

Student B (See Figure 2), a reader from the middle group, combined 20 of the kernels into 11 of his sentences, almost a 2 to 1 embedding ratio. On words per T-unit (79 words divided by 12 T-units), he achieved a 6.58 words per T-unit. This was 2.27 below Hunt's norms for the middle group of 8.85. The fact that the middle mean was below Hunt's may be due to the fact that the low ability level was very low at Hartford and tended to pull down the middle.

Student C (See Figure 2), a reader from the low group, combined 12 of the kernels into 11 of his, almost a 1 to 1 embedding ratio. On words per T-unit (51 words in 11 T-units), he achieved a 4.64 words per T-unit. Hunt's computed norm for the low group at seventh grade is 6.64. The low

reader fell 2.00 below Hunt's norm on syntactic maturity. Student C had to be helped with sentence combining up until two weeks of the end of the research project, which confirms the accuracy of the syntactic maturity score. In fact, Student C was lower than the low group for fourth grade on Hunt's syntactic maturity scale. Since third grade reading material was difficult for him, he was probably around third grade level in both reading and syntactic maturity.

Two students seemed atypical of their groups based on their response to the Aluminum passage. One of the high readers on the basis of the cloze, scored at about the middle range on the Aluminum instrument, prior to sentence combining practice. However, as soon as the class sessions started with sentence combining (She was in the experimental group), almost immediately she proved to be one of the most sophisticated in doing the exercises. Apparently she had not understood the directions for performing the initial sentence combining on the Aluminum passage. Another reader, from the low group, began by using some transformations and then resorted to mazes. She was one of the low group to make rapid progress in sentence combining. Perhaps she was developmentally ready, but was not quite sure of herself. A sample from her work follows, without correction for spelling, and with her punctuation retained:

> Aluminum is a abundant of metal it comes from bauxite with [which?] is a ore that looks like clay. Bauxite contains aluminum and several other substances. Workmen extract grind the subatances bauxite they put it in tanks and Fressurs the other substances in mass they remove the

mass they filters A liquid remains they Put it through Several other processes. the chemical it is a mixture it contains alumnum it contains workmen separate the aluminun from the oxygen...

Except for the two students mentioned, who seemed to be somewhat atypical of their group, those who measured high on cloze measured high on the syntactic maturity scale, those at the middle on cloze were also at the middle on syntactic maturity, and those at the low, also at the low on syntactic maturity. [The student from the low group whose sentence combining is shown directly above would also have to be considered low in syntactic maturity in view of the mazes following her first two sentences.] The following tables illustrate this close relationship. Spelling and punctuation are adjusted in each case for greater readability. Eleven sentences are drawn from each student's work in order to make the results of their sentence combining more comparable.

Figure 1.

Excerpt of sentence combining from a student in the high reading level, using the Aluminum paragraph developed for measuring syntactic maturity for research purposes (Hunt, 1970; Pp. 64-65)**

STUDENT A: (High reading ability level)

1. *Aluminum is an abundant metal that comes from bauxite.*
[K1: Aluminum is a metal] [K4: It comes from bauxite]
[K2: It is abundant] *[K3: Omitted]

2. *Bauxite is an ore that looks like clay.*
[K5: Bauxite is an ore] [K6: Bauxite looks like clay]

3. *Bauxite contains aluminum and several other substances.*
[K7: Bauxite contains aluminum] [K8: It contains several other substances]

4. *Workmen extract these other substances from the bauxite.*
[K9: Workmen extract these other substances from the bauxite]

5. *Then the bauxite is ground and put in tanks that have pressure in them.*
[K10: They grind the bauxite] [K11: They put it in tanks]
[K12: Pressure is in the tanks]

6. *They remove the mass other substances have formed with filters.*
[K13: The other substances for a mass] [K14: They remove the mass]
[K15: They use filters]

7. *The liquid that remains is put through several other processes.*
[K16: A liquid remains] [K17: They put it through several other processes]

8. *It finally yields a white powdery chemical that is alumina.*
[K18: It finally yields a chemical]
[K19: It is powdery] [K21: The chemical is alumina]
[K20: It is white]

9. *It is a mixture that contains aluminum and oxygen.*
[K22: It is a mixture] [K23: It contains aluminum] [K24: It contains oxygen]

10. *Workmen use electricity to separate the aluminum from the oxygen.*
[K25: Workmen separate the aluminum from the oxygen]
[K26: They use electricity]

11. *They finally produce a light metal that has bright silvery luster.*
[K27: They finally produce a metal] [K29: It has a luster]
[K28: The metal is light] [K30: The luster is bright]
[K31: The luster is silvery]

*[K3: It has many uses] was omitted by the student.

** Reprinted by permission of the Society for Research in Child Development.

Figure 2.

Excerpts of sentence combining from students in the middle and low reading level, using the Aluminum paragraph developed for measuring syntactic maturity for research purposes (Hunt, 1970: Pp. 64-65)

STUDENT B: (Middle reading ability level)

1. *Aluminum is abundant metal.* 2. *It has many uses.* 3. *It comes from an ore.*
[K1: Aluminum is a metal] [K3: It has many uses] [K4: It comes from bauxite]
[K2: It is abundant]

4. *The ore is called bauxite.* 5. *It looks like clay.* 6. *It contains aluminum.*
[K5: Bauxite is an ore] [K6: Bauxite looks like clay] [K7: Bauxite contains aluminum]

7. *There are seven other substances that workmen extract from the bauxite.*
[K8: It contains several other substances] [K9: Workmen extract these other substances from the bauxite]

8. *They grind the bauxite and put into pressured tanks.* 9. *The other substances*
[K10: They grind the bauxite] [K11: They put it into tanks]
[K12: Pressure is in the tanks] [K13: The other substances for a mass]

in the mass are removed by filters. 10. *A liquid remains and then they put it*
[K14: They remove the mass] [K15: They use filters] [K16: A liquid remains]

through seven other processes.
[K17: They put it through several other processes]

11. *Then finally they come up with a powdered substance that is white.*
[K18: It finally yields a chemical] [K19: The chemical is powdery]
[K20: It is white]

STUDENT C: (Low reading ability level)

1. *Aluminum is an abundant metal.* 2. *It has many uses.* 3. *It comes from bauxite.*
[K1: Aluminum is a metal] [K3: It has many uses] [K4: It comes from bauxite]
[K2: It is abundant]

4. *Bauxite is an ore.* 5. *Bauxite looks like clay.* 6. *Bauxite contains aluminum.*
[K5: Bauxite is an ore] [K6: Bauxite looks like clay] [K7: Bauxite contains aluminum]

7. *It contains several other substances.* 8. *Workmen extract these other substances.*
[K8: It contains several other substances] [K9: Workmen extract these other substances]

9. *They grind the bauxite.* 10. *They put it in tanks.*
[K10: They grind the bauxite] [K11: They put it in tanks]

11. *Pressure is in the tanks.*
[K12: Pressure is in the tanks]

THE STUDY IN DETAIL

METHOD

Subjects and procedure for pairing:

Sixty-six seventh grade students from two school systems near Kalamazoo, Michigan (the Hartford Public Schools and the Otsego Public Schools) were given cloze pretests. On the basis of the scores from these pretests, 24 students were selected: 12 experimental students and 12 controls (6 experimental and 6 control from each school). Four factors were considered in pairing the 12 experimental students with the 12 controls:

(1) Percentile range. For each school on the basis of the cloze tests, two subjects were drawn from the high group, two from the middle group and two from the low group. These students were paired with six control subjects scoring within a five percentile range of their counterparts in the experimental groups. The same procedure was followed in the second school.

(2) Teacher judgment and IQ. Within the five percentile range, the teacher selected subjects whose IQ, based on prior school tests, and general mental performance, based on teacher judgment, would be expected to perform similarly given the same mental stimulus. This type of selection was possible because the same teacher taught both experimental students and control students.

(3) Non-isolation of subjects. Students selected for the experiment were to remain with their classmates so that an artificial situation could be prevented. All students in the room with the experimental subjects received the same treatment, and all students in the room with the control subjects received the same treatment as the control subjects.

This was no problem for either school, since there were several seventh grade English classes meeting at different hours of the day and taught by the same teacher. Only the experimental and control subjects were scored, however.

(4) Sex of subjects. The sex of students as a variable was considered and dismissed as a basis of pairing. The data from similar studies in which sex was used as a variable have shown mixed or non-significant differences.

Seventh graders were selected for this study for several reasons: (1) this age group can handle more complex syntax than beginning readers, which would enable more readily discernible growth in measurement; (2) by middle school age, children have firmly established reading strategies; (3) the work of Mellon and O'Hare for stimulating growth in writing could serve as models for the number of hours exposure to the treatment, as well as for selection of the type of sentence combining problems useful at that level, since their work was with seventh graders.

TREATMENT AND VARIATION BY SCHOOL

Because the research grant began in January of 1974 and extended until the following January, it was decided to limit the types of sentence combining to the most productive, the adjective clause and its reductions, which Hunt referred to when he stated: "We see then, that the subordinate clause index is a team which moves ahead, but it moves ahead because one member [the adjective clause] does all the work." (See p. 192 in "Recent Measures in Syntactic Development" in Lester, 1970) There was also no assurance that the same teachers and the same groups could be held together longer than for one

semester. For the same reason, the number of hours per week was increased to adjust to a shorter time span. Another time-limiting factor was the fact that the second semester for both schools began during the third week of January. Because the end of the first semester occupied both teachers and students in end-of-semester activities, the initial cloze tests for identifying experimental and control subjects was deferred until the beginning of the second semester. Other pretests, too, (See Tests) took time from the initial weeks of the second semester.

The treatment was slightly different in time-span and intensity for the two schools, reflecting the difference in general ability-level of students, as well as a difference in the structuring of classes. Therefore, each school will be considered separately.

Hartford School: The school is influenced some by migrant labor, coming in to harvest the fruit that is the chief agricultural crop for this community and sometimes staying on as permanent residents. There is also a large laboring class working in agriculture-related industries (fruit processing, etc.). The ability-level of the students from this school fell below that of the students from the Otsego school for the lower and middle groups of students. However, it was higher for the upper ability-level students, who reflected a higher socio-economic level of employers of labor. As a consequence, for those scoring lowest and at the middle range on the cloze test, more time had to be spent on work with the developmentally less sophisticated types of sentence combining (full relative clauses--unreduced, and pre-noun adjectival modifiers) before the low to middle groups of experimental students could go on to embeddings that introduced as noun modifiers participles, participial

phrases, appositive phrases, compounds, and multiple pre-noun adjectives. One of the low-scoring subjects had to be helped with even the simpler forms of sentence combining, being unable to work independently until within two weeks of the end of the study (See Student C in Figure 3).

The experimental group had 10 weeks of total time in sentence combining. For the first 5 weeks, these students spent 2-3 hours per week in sentence combining problems. Later, because word was received that classes would be reshuffled in late April or early May, the time spent on clause consolidation was stepped up to 5 hours per week. For a few students, still having difficulty, the time was 6-7 hours. Total time, then, was approximately 37 hours of treatment for most subjects in the experimental group.

The experimental group* as a whole was a very enthusiastic group and looked forward to the problem-solving as to a game. The students selected from this group for the experiment were as enthusiastic about what they were doing as the others. When experimental subjects were not engaged in sentence combining problems, they worked on activities similar to those of the control group.

Control students. During the 10 weeks that the experimental group were engaged in sentence combining, the control group worked largely on a newspaper unit. They talked about articles and how papers were put together, how different papers reflected a certain kind of reader, etc. They compared news stories, made layouts for a newpaper, and other related activities. Most of this activity was oral discussion, but some involved writing.

*The whole class doing sentence combining, including the six subjects being scored.

Otsego School.

As with the Hartford School, the second semester for the Otsego School did not begin until the last week of January, so that pretests and sentence combining activities had to be delayed while final tests and end-of-semester activities were being completed. In general, the first semester was largely devoted to reading for seventh grade English classes. In the second semester (the time of this study), the emphasis was on oral language through plays and speeches, usage, spelling, and practical skills, although some attention was given to literature.

Experimental group. Experimental subjects were given sentence combining on a two-hour-per-week basis for 13 weeks, resulting in a total of 26 hours of experimental work for most subjects. Some, in addition, took work home, raising the total by perhaps another 1-3 hours. This group, as with Hartford, showed enthusiasm for the work, looking upon it as a puzzle to be worked. No lag in interest ever emerged, even by the end of the experiment.

Control Group. The activities of the control group were quite varied. They worked on punctuation, quotation marks, commas, and other matters of grammatical usage. Occupations were explored and speeches given on these. Business letters and job-application letters were written. There was also work on vocabulary and on spelling from a list in their books. Literature occupied a portion of time, too, with discussion of poetry and a larger unit of three weeks devoted to work on a play. For the latter the students divided into groups, each group being responsible for one scene, culminating in the acting out of the entire play. Both the experimental and the control groups worked on the plays, with the experimental group joining in when they were not engaged in sentence

combining. There was also a free reading period on Friday in which both the experimental and control groups took part. The experimental group also took part in some of the other activities of the control group when this was possible.

Teachers administering the sentence combining and tests.

Both experimental and control students in each school had the same teacher. For each school these were highly capable former students of the investigator. Both had been outstanding students in linguistics, and both had training in miscue analysis. For the Hartford School the teacher was the students' full time teacher. For the Otsego School the person administering the sentence combining and tests was the practice teacher, acting with full support of the regular teacher. In both schools the rapport with students was excellent. By having the same teacher for both the control students and the experimental students, the teacher variable could be held to the minimum.

MATERIALS FOR SENTENCE COMBINING

Problems for sentence combining were constructed largely by the investigator. Some were also constructed on the spot by the teacher at Hartford to give some individuals more practice in a particular type of transformation when needed. A few were developed by one of the research assistants. In addition, material from William Strong's Sentence Combining (1973) was used, particularly at Hartford, and especially for the higher level students. The basic, almost kernel, sentences in Strong's book were on subjects particularly interesting to students at this level. In the beginning, however, it was found that all students, even the better ones, needed

the preliminary models and exercises developed for this research study.

It was decided to avoid grammatical terminology in constructing the problems in order to preserve the game or puzzle aspects of the exercises. Only minimal labels were employed to identify certain types of transformations in order to surface some awareness by the student of the syntactic element being embedded. An outline method was used with initial examples for each type, much like those used by O'Hare (1973) and Cooper (1973). Examples of some of the sentence combining problems are shown in Figure 3. Although only one problem is given under each model in Figure 3., in actual practice about 10 of each type were given for students to do. In addition to the types of sentence combining shown in Figure 3, students were exposed to those creating other types of noun modifiers: prepositional phrases, noun appositives, compounds, and adverbs as modifiers. Multiple embeddings were also given.

FIGURE 3. EXAMPLES FROM SENTENCE COMBINING EXERCISES

The following models illustrate ways of combining sentences for sharpening and condensing ideas and eliminating deadwood. In addition to the models there are sentences for you to combine. (Write your answers.)

A. Adjective as Noun Modifier

The face peered at me through the window.
The face was hideous.
Results: The hideous face peered at me through the window.

My brother tore up my book.
My brother is little.
Results:

B. Clauses as Noun Modifiers (using who, which, that, when, where)

She saw the movie.
The movie made her feel strange. (which/that)
Results: She saw the movie which made her feel strange (or, that made....)

C. Present Participle as Noun Modifier (-ing of verb)

Mary saw the girls.
The girls were dancing.
Results: Mary saw the girls dancing (or, Mary saw the dancing girls.)

The boys ran through the tent.
The boys were screaming.
Results:

D. Present Participle-headed Phrases as Noun Modifiers. (-ing + other words)

I stepped on a snake.
The snake was slipping into the pond.
Results: I stepped on a snake slipping into the pond.

Mabel saw a black sedan.
The black sedan was streaking down the highway.
Results:

E. Past Participle as Noun Modifier (-en/-ed of verb)

The house smelled of coffee.
The coffee was roasted.
Results: The house smelled of roasted coffee.

The robbers fled in the car.
The car was damaged.
Results:

STATISTICAL METHODS

In order to look at a number of variables and yet control the size of population, a t-test for correlated samples was constructed. Seven tests were devised to measure the variables:

(1) Cloze tests were used both for the initial pairing of experimental and control students and for assessing their beginning and ending strength on structural and semantic meaning in reading. The cloze test has long been considered by researchers as one of the more objective tests for measuring reading ability, particularly because it can operate independent of such variables as memory. Recent studies have confirmed its validity (Bormuth, 1968, 1969; Ramanauskas, 1972; Horton, 1973). Every fifth word was omitted from passages of Profiles in Courage (Kennedy, 1956) for both pretest and posttest, providing a total of 53 slots for the students to fill for each test. The posttest was taken from the same book, using a slightly more difficult selection so that normal development would not confuse sentence combining gains.

(2) Gates-MacGinitie tests (Gates-MacGinitie, 1965) for speed and also for accuracy were used to determine whether experimental groups would gain significantly in speed and accuracy. Although gains could not be read as proof, they might show some indication as to whether sentence combining might result in greater speed through increased chunking, and accuracy through more accurate predicting. Survey E, Form 1M was used for the pretest, and Survey E, Form 3M was used for the posttest.

(3) Miscue Inventories (Goodman and Burke, 1972) were scored for each correlated pair of subjects on four measures: miscue grammatical strength; miscue grammatical strength + partial strength; miscue comprehension strength; and miscue comprehension strength + partial strength. Miscue

inventories, while time-consuming to administer and score, provide a more sensitive instrument for determining gains in grammatical relations and semantic relations because they provide windows into the reading process, as Kenneth Goodman has pointed out (Goodman, 1973). Since the sentence combining practice was for less than one semester, it was decided that a sensitive instrument might be needed to determine direction if the gains were small, especially since most studies using sentence combining extended over one school year.

Separate scores are shown for "strength + partial" for both grammatical relations and for comprehension on miscue tests, as well as for strength for each. A gain in partial strength could then be apprehended on each of these measures. An example of partial strength in grammatical relations would be a miscue which preserved the grammatical relations for part of the sentence, but did not fit with the balance. Partial strength in comprehension would be a partial fit semantically.

The students were taped by the teacher who also marked the miscue selections for later scoring by the research assistants. Students were given one selection of non-fiction and one of fiction. The length of the selection was gauged to achieve a total of 25 miscues from each genre, making a total of 50 miscues per student. Goodman and Burke (1972, p. 20) suggest 25 miscues as a minimum number. The two selections were decided upon partly to increase the validity of the instrument and partly to find out if interest would be a factor, too. One selection of fiction was picked for each level which the researcher and assistants considered to be high in interest, and one was picked from non-fiction which seemed uninteresting. Approximately 600 words were used per selection.

Selections for the top readers for both pretest and posttest in both genres were drawn from Pooley and others (Eds.) Good Times through Literature (1956). The Preface suggests that the selections are geared for ninth grade. For the middle readers for both pretest and posttest, the fiction was drawn from Weiss and Hunt (Eds.), Riders on the Earth (1973), a sixth grade text. The nonfiction selections were drawn from Piltz and Van Bever (Eds.), Discovering Science 6 on the topic of lightning for the pretest and on astronomy for the posttest. For the low readers for both pretest and posttest, a biographical selection told in narrative form was used from Johnson-Sickels-Sayers (Eds.), Anthology of Children's Literature (1970). The selection was listed as between 3rd and 4th grade levels. Nonfiction was drawn from Dolman and others (Eds.), Science through Discovery 3 . The pretest was on the subject of how amphibians get food; the posttest was on how animals take care of their young. In every case, some effort was made to have the final selection slightly more difficult in syntax than the beginning selection, to control for developmental gains, but not appreciably so since the span of time for the treatment was approximately three months out of a nine-month academic year.

Differences in mean, standard deviation, and t-scores between experimental and control groups on all seven measures were computed separately for both pretest and posttest for each school as shown in Tables I-V. The combined scores for both schools were then computed as shown on Table VI. Differences in mean gain between pretest vs. posttest measures for experimental and control groups for each school were then computed as shown on Tables VII and VIII. The combined scores for the two schools on these differences in mean gain are shown on Table IX.

TABLE I

Difference in mean between experimental and control groups on pretest measures for Hartford School

TEST	N	GROUP	MEAN	SD	t
1. Cloze	6 6	Experimental Control	35.67 33.33	12.58 11.84	-2.907 *
2. Gates-MacGinitie speed	6 6	Experimental Control	49.00 54.50	7.29 11.04	1.251
3. Gates-MacGinitie accuracy	6 6	Experimental Control	47.67 50.67	9.58 12.45	.800
4. Miscue grammatical strength	6 6	Experimental Control	63.33 60.67	9.96 10.41	-.399
5. Miscue gramm. str. + partial	6 6	Experimental Control	82.50 85.03	8.33 11.19	.574
6. Miscue comprehension strength	6 6	Experimental Control	47.50 39.83	18.81 16.35	-.614
7. Miscue comp. str. + partial	6 6	Experimental Control	71.29 63.17	15.43 10.14	-1.098

* Significant at .05 level
† Significant at .01 level

TABLE II

Difference in mean between experimental and control groups on pretest measures for Otsego School

TEST	N	GROUP	MEAN	SD	t
1. Cloze	6 6	Experimental Control	37.00 35.33	15.14 15.81	-1.274
2. Gates-MacGinitie speed	6 6	Experimental Control	46.33 51.50	8.50 6.69	2.688*
3. Gates-MacGinitie accuracy	6 6	Experimental Control	47.17 52.50	9.04 10.05	3.239*
4. Miscue grammatical strength	6 6	Experimental Control	59.00 56.92	15.09 15.83	-.255
5. Miscue gramm. str. + partial	6 6	Experimental Control	72.92 85.83	14.68 8.01	1.783
6. Miscue comprehension strength	6 6	Experimental Control	50.92 53.25	18.76 12.35	.231
7. Miscue comp. str. + partial	6 6	Experimental Control	64.83 63.08	11.66 13.35	-.229

* Significant at .05 level
† Significant at .01 level

TABLE III

Difference in mean between experimental and control groups on pretest measures for both schools (Hartford and Otsego)

TEST	N	GROUP	MEAN	SD	t
1. Cloze	12 12	Experimental Control	36.33 34.33	13.29 13.36	-2.708*
2. Gates-MacGinitie speed	12 12	Experimental Control	47.67 53.00	7.68 8.84	2.332
3. Gates-MacGinitie accuracy	12 12	Experimental Control	47.42 51.58	8.89 10.83	2.100
4. Miscue grammatical strength	12 12	Experimental Control	61.17 58.79	12.40 12.92	-.473
5. Miscue gramm. str. + partial	12 12	Experimental Control	77.71 85.46	12.43 9.28	1.780
6. Miscue comprehension strength	12 12	Experimental Control	49.21 46.54	18.00 15.49	-.342
7. Miscue comp. str. + partial	12 12	Experimental Control	68.06 63.13	13.47 11.31	-.957

* Significant at .05 level
† Significant at .01 level

TABLE IV

Difference in mean between experimental and control groups on posttest measures for Hartford School

TEST	N	GROUP	MEAN	SD	t
1. Cloze	6 6	Experimental Control	30.00 29.00	15.15 9.25	-.218
2. Gates-MacGinitie speed	6 6	Experimental Control	50.33 52.83	9.50 7.91	.730
3. Gates-MacGinitie accuracy	6 6	Experimental Control	48.67 50.17	7.06 8.84	.491
4. Miscue grammatical strength	6 6	Experimental Control	76.50 51.17	1.87 17.28	-3.534*
5. Miscue gramm. str. + partial	6 6	Experimental Control	93.04 76.25	5.44 18.50	-1.808
6. Miscue comprehension strength	6 6	Experimental Control	65.25 36.75	10.23 18.83	-3.643*
7. Miscue comp. str. + partial	6 6	Experimental Control	86.83 62.67	5.37 21.09	-2.647*

* Significant at .05 level
† Significant at .01 level

TABLE V

Difference in mean between experimental and control groups on posttest measures for Otsego School

TEST	N	GROUP	MEAN	SD	t
1. Cloze	6 6	Experimental Control	43.17 37.67	5.42 15.74	-1.068
2. Gates-MacGinitie speed	6 6	Experimental Control	47.33 47.33	4.27 6.12	000
3. Gates-MacGinitie accuracy	6 6	Experimental Control	47.83 44.67	8.77 8.04	-.663
4. Miscue grammatical strength	6 6	Experimental Control	66.42 56.92	17.30 19.57	-1.159
5. Miscue gramm. str. + partial	6 6	Experimental Control	85.58 88.17	8.03 8.48	.599
6. Miscue comprehension strength	6 6	Experimental Control	58.00 47.25	13.64 21.97	-1.095
7. Miscue comp. str. + partial	6 6	Experimental Control	75.08 61.33	13.95 19.12	-1.789

* Significant at .05 level
† Significant at .01 level

TABLE VI

Difference in mean between experimental and control groups on posttest measures for both schools (Hartford and Otsego)

TEST	N	GROUP	MEAN	SD	t
1. Cloze	12 12	Experimental Control	36.58 33.33	12.84 13.12	-.968
2. Gates-MacGinitie speed	12 12	Experimental Control	48.83 50.08	7.20 7.33	.586
3. Gates-MacGinitie Accuracy	12 12	Experimental Control	48.25 47.42	7.61 8.55	-.298
4. Miscue grammatical strength	12 12	Experimental Control	71.46 54.04	12.86 17.86	-3.049*
5. Miscue gramm. str. + partial	12 12	Experimental Control	89.31 82.21	7.61 15.07	-1.249
6. Miscue comprehension	12 12	Experimental Control	61.62 42.00	12.10 20.26	-2.994*
7. Miscue comp. str. + partial	12 12	Experimental Control	80.96 62.00	11.80 19.20	-3.212†

* Significant at .05 level
† Significant at .01 level

TABLE VII

Difference in mean gain between pretest vs. posttest measures for experimental and control groups for Hartford school

TEST	N	GROUP	MEAN GAIN	SD	t
1. Cloze	6 6	Experimental Control	-5.00 -3.67	7.04 7.34	.287
2. Gates-MacGinitie speed	6 6	Experimental Control	1.67 -1.17	5.89 3.66	-1.000
3. Gates Mac-Ginitie accuracy	6 6	Experimental Control	1.50 - .17	3.78 3.54	-1.327
4. Miscue grammatical strength	6 6	Experimental Control	13.17 -9.49	9.02 12.22	-5.214†
5. Miscue gramm. str. + partial	6 6	Experimental Control	10.54 -8.83	8.00 26.96	-1.625
6. Miscue comprehension strength	6 6	Experimental Control	17.75 -3.08	10.04 18.00	-2.185
7. Miscue comp. str. + partial	6	Experimental Control	15.54 -.50	13.34 18.54	-2.102

* Significant at .05 level
† Significant at .01 level

TABLE VIII

Difference in mean gain between pretest vs. posttest measures for experimental and control groups for Otsego school

TEST	N	GROUP	MEAN GAIN	SD	t
1. Cloze	6 6	Experimental Control	6.50 2.67	11.18 6.06	- .849
2. Gates-MacGinitie speed	6 6	Experimental Control	1.50 -3.50	9.42 9.31	-1.349
3. Gates-MacGinitie accuracy	6 6	Experimental Control	1.00 -7.17	11.24 8.23	-1.680
4. Miscue grammatical strength	6 6	Experimental Control	7.42 .00	5.89 13.64	-1.564
5. Miscue gramm. str. + partial	6 6	Experimental Control	12.67 2.34	10.96 6.10	-1.695
6. Miscue comprehension strength	6 6	Experimental Control	7.08 -5.99	6.79 18.91	-1.318
7. Miscue comp. str. + partial	6 6	Experimental Control	10.25 -1.75	6.01 19.60	-1.593

* Significant at .05 level
† Significant at .01 level

TABLE IX

Difference in mean gain between pretest vs. posttest measures for experimental and control groups for combined schools (Hartford and Otsego)

TEST	N	GROUP	MEAN GAIN	SD	t
1. Cloze	12 12	Experimental Control	.75 - .50	10.75 7.22	- .392
2. Gates-MacGinitie speed	12 12	Experimental Control	1.58 -2.33	7.49 6.85	-1.742
3. Gates-MacGinitie accuracy	12 12	Experimental Control	1.25 -3.67	8.00 7.06	-1.901
4. Miscue grammatical strength	12 12	Experimental Control	10.29 -4.75	7.86 13.31	-3.924†
5. Miscue gramm. str. + partial	12 12	Experimental Control	11.60 -3.24	9.22 19.53	-2.276*
6. Miscue comprehension strength	12 12	Experimental Control	12.42 -4.54	9.89 17.67	-2.545*
7. Miscue comp. str. + partial	12 12	Experimental Control	12.89 -1.12	10.25 18.20	-2.724*

* Significant at .05 level
† Significant at .01 level

FINDINGS

The findings from this study are taken up separately as each one relates to the predictive powers of the Venezky and Calfee Reading Competency Model discussed earlier under "The Purpose of the Study." (Venezky and Calfee, 1970)

a) High speed visual scanning. As shown on Table IX, the combined scores for the mean gain between pretest vs. posttest measures for experimental and control groups on the Gates-MacGinitie measure for speed showed a substantial trend in the direction of the experimental group, but a non-significant one. If more visual scanning took place, it did not reach sufficient levels for confirmation.

b) Search for the LMU (Largest Manageable Unit). Awareness of grammatical relationships (how words interrelate in larger groupings), as measured by Miscue Grammatical Strength reached the .01 level of confidence at the Hartford School, where the more intensive practice in sentence combining resulted in 36 hours of treatment (See Table VII). Grammatical Strength + Partial was also significant, reaching the .05 level at the Hartford School. The combined gains from both schools were also significant at the .01 level of confidence (See Table IX). However, the gains for the Otsego school alone showed only a non-significant trend in the direction of the experimental group (See Table VIII). There does seem to be some confirmation of an increase in awareness of syntactic relationships, i.e., an awareness of a word in relation to units beyond the word. Although it cannot be stated with certainty that the search is for the largest manageable unit, the search is certainly beyond the word itself to an organizing principle. The model shows real promise here.

c) Syntactic-semantic integration (a part of the "dual processing" in the Venezky and Calfee model). The greater ability of the experimental groups to recover deep structure, or meaning, from the surface structure of what they read appears confirmed. The gains for the experimental groups on Miscue Comprehension Strength as well as on Miscue Comprehension Strength + Partial for the combined schools was at the .05 level of confidence (See Table IX). The gains for both schools separately, however were in the direction of the experimental group but nonsignificant for the smaller populations. On cloze procedure, which is thought to measure a subject's ability to deal with linguistic structure, especially in the relationship between words and ideas (See Horton, 1973; p. 170), there was a direction towards the experimental group for the Otsego school (Table VIII), as well as on the combined scores (Table IX), but the gains were nonsignificant.

Although the Venezky and Calfee model (The Reading Competency Model) does not specifically discuss greater accuracy of prediction in reading, it would probably be subsumed under the active process of searching for an organizing principle and the final product of "reading competency." The Gates-MacGinitie accuracy tests, however, while showing a substantial gain in the direction of this greater accuracy, did not reach a level of significance (See Table IX). (See also "Limitations.")

DISCUSSION

MAIN FINDINGS:

1. There appears to be an extremely close link between a student's reading level and that same student's syntactic maturity level based on measures developed by Hunt and O'Donnell. Although the population on which the Aluminum instrument was used was small (used with one seventh grade class at Hartford), this measurement did confirm such a relationship. Further confirmation came from the greater dependence of both the poorer readers and the middle readers upon teacher help during the sentence-combining sessions. As was noted earlier, one of the low readers had to be helped with the embedding exercises until within two weeks of the end of the research study before he could work independently. The better readers went quickly through the problem-solving materials prepared for the research project, including the more difficult multiple embeddings and participle-headed phrase embeddings, etc., and then worked largely in the Strong (1973) book. The error rate on the more difficult types of embeddings was high for both the lowest and middle groups of readers. Although the Aluminum measurement was added largely for its value as a predictor for future research, it did shed light on the classroom behavior of students working with transformations.

2. The greatest gains in reading comprehension from sentence combining appeared to be from among the lower and middle group of readers. Both miscue analysis and teacher observation support this view. According to

teacher observation, those students not chosen as part of the study but receiving the experimental treatment also made substantial gains, especially those in the lower half of the reading ability range.

3. An interesting sidelight of the research study is that the selections picked by the investigator and assistants as "boring" or "interesting," appeared to yield quite mixed results, if students' comprehension scores could be considered as reflecting, at least to some degree, their interest. The terms "boring" and "interesting" were therefore changed to "fiction" and "nonfiction." Some students from the same ability level, and this was true for all three levels (high, middle, and low), achieved considerably higher comprehension scores on one of the two selections, while other students from that same level scored poorer on the same selection and much higher on the other one. Difficulty level of the material, therefore, had to be ruled out. It was outside the range of this study to determine what the causative factor(s) was (or were), but selection factors which cause this much difference in students' comprehension ought to be investigated. If difference in interest could make these changes, then motivation as a tool has not been sufficiently used for reading comprehension.

4. Writing fluency made large gains, according to teacher observation. For example, one of the low ability readers in the experimental group at Hartford had not been known to write with greater complexity than with the use of "and" in his free writing until later in the study. He then began to use relative clause transformations. Other teachers in the building who had the student for a class noted the change and asked what had happened to improve his writing.

5. Grammatical sensitivity seemed to increase faster than comprehension. Some students, still wedded to the notion that reading is identifying small graphophonic pieces, made considerable gains in grammatical strength, but these gains were largely in nonsense words which inflected for the part of speech suggested by the stimulus word or were accompanied by a function word which signalled that part of speech. Since words have both syntactic and semantic meaning, it was expected that some increase in awareness of syntax would cue greater awareness of semantic meaning. Such seemed to be the case for a number of readers but not for all. Sentence combining can be a catching up device for greater syntactic awareness. It can also remove syntactic roadblocks to comprehension, it appears. However, if a student is not reading for meaning, it appears that greater syntactic awareness does not necessarily mean greater comprehension, that it is not a panacea, but rather, a facilitator.

6. Enthusiasm for sentence combining ran high for the entire duration of the research study, especially at Hartford. The students looked forward to each class session and treated the work as problem solving or as working puzzles. Even the low reading ability students, who required so much help in doing the sentence combining, enjoyed the activity. How soon the effect of too much of one thing would become a negative factor is not known. From teacher observation, there seemed to be no diminution of interest by the end of the study. Perhaps as long as the work remains challenging, and therefore needed, interest will remain high, especially if the puzzle solving aspects are maintained "untainted" by formal grammar.

7. Part of the gain for the experimental groups was a result of no gain (or a slight retrogression) by the control students who had been working in areas not as closely related to manipulating language as they had been

in the first semester with its heavy emphasis on reading, or as the experimental group had from both the first semester's strong emphasis on reading plus the second semester's work (intensive work at Hartford) with manipulating phrases and clauses and experimenting with sentence patterns. Possibly the loss for the controls was more apparent than real, due to a somewhat more difficult test, and due to a temporary disorientation, something that frequently happens when a person is away from a subject for a while.

LIMITATIONS

Several factors were not anticipated, in one case, could not have been anticipated.

1. No provision was made for alternate selections for the miscue tests in case the selection provided was too easy or difficult. Fortunately, all selections proved to be of suitable difficulty level and length except for those given to the top readers. Three of the top students at Hartford found the materials too easy and made less than 25 miscues (from 8-17). The other high reader at Hartford made 38, however. The same selections at Otsego with the high students, both experimental and control, induced from 31-41 miscues, well over the 25 deemed necessary by the Goodman and Burke (1972) manual.

2. The cloze test given was taken from literature. At the time it was constructed, the extensive study on cloze procedure by Horton (1973) in his doctoral dissertation was not known to the investigator. His early findings were that literary selections had the additional variable of author style and did not yield as reliable results as selections from science, for example. Consequently he omitted the literary selections from his study. In addition, he found that a preliminary practice session and very thorough directions should be given prior to a cloze test to assure reliable results. No preliminary practice session was given in this test. Although directions were given, they were not as thorough as Horton considered desirable. It was clear in looking at the tests that some students had simply plugged in any answer. Although these students were not picked for the study, there may still have been a degree of error caused by lack of prior training and more thorough directions. Another flaw in the cloze

tests was their difficulty level. After the first test was administered, the teachers sent back word that the test was too difficult. Unfortunately, the time factor did not permit the preparation and administering of another test. The second test was taken from another part of the same chapter from the same book (Kennedy, 1956) to keep the tests parallel. However, the material was still too sophisticated syntactically and semantically, even for the experimental students, to be a suitable test.

3. More complete preliminary directions should have been given to those administering the miscue testing. There were a number of instances of miscues which appeared to be mispronunciations of words rather than non-words. However, experience has shown that many times a child can know the meaning of a word and still mispronounce it. If those administering the tests could have later asked the student what that word meant, more accurate tabulation of results would have been possible. No retelling check was made because of the time limitations which so many tests required.

4. It was not known that the seventh grade classes at Hartford would be shifted before the end of the semester. After this shift was known and the practice sessions were made more intensive to partially compensate, the change was made sooner than expected. Some of the ending materials had to selected more rapidly than would have been ideal. In addition, some students had to be located in other classrooms for the ending test.

5. Although the Gates-MacGinitie tests are widely used for measuring reading ability, the speed and accuracy section used to measure these qualities in this study seemed not to be particularly valid. For

accuracy, the Miscue Analysis Inventory would seem to be a much more sensitive instrument for measuring. On this instrument every deviation from the text is noted and analyzed qualitatively. The Gates-MacGinitie test, on the other hand, uses a number of short selections of from one to two sentences with a partial sentence to be completed by circling one of four possible answers. The circling could, of course, be done by guessing, or the wrong answer could be circled for the right reasons. An example from Survey E, Form 3M, is as follows:

1. Star sapphires are precious gems with a star of light inside. Even when cut into smaller pieces, each will have a star. These stones are used for

A	B	C	D
roads	jewelry	gardens	buildings

If a student had visited a cathedral in which gems were used for ornamentation, he or she might very well circle "buildings," not for lack of comprehension, or accuracy of reading, but for lack of sufficient world knowledge on that subject.

Perhaps Miscue Analysis, using a sufficiently lengthy selection for more contextual information, would eliminate this need for greater world knowledge, for context can limit alternatives. In addition, every deviation from the text would be noted.

For speed, possibly a stop watch for timing a continuous prose passage would be a more sensitive measure. It would at least eliminate the time spent by students in debating which answer to circle, which is scarcely time spent in reading.

RESEARCH IMPLICATIONS

There are six major implications for future research suggested by the data:

1. Since the largest gains in this study were by students from the lower half of the classes on reading scores, studies should be undertaken to determine whether this finding holds true on larger populations.

2. Sentence combining as a means for helping readers search for the largest manageable unit as posited in the Venezky Calfee Reading Competency Model shows promise from this study. Further validation should be considered. Since increased awareness of grammatical relations was significant from sentence combining, it would be interesting to determine whether eye-voice span showed a corresponding increase when test materials included the transformations used in the treatment. Pretest and posttest tachistoscopic studies might validate the search for the largest manageable unit as an outgrowth of greater facility with syntactic patterns (embedding transformations). If eye-voice span widened as a result of sentence combining to incorporate genuine linguistic units as students become aware of these units, then this aspect of the model would have further validation. Sentence combining would also be seen to be the facilitating factor.

3. The close correlation found in this study between the reading level of students and their syntactic maturity levels on the Aluminum instrument suggests the need for a study using a larger population and examining all measures of syntactic growth as identified by Hunt (1970): words per T-unit, clause length, clauses per T-unit, embeddings per T-unit, as well as clauses reduced to movables. Such research might establish whether the correlation noted exists on all measures.

4. Since comprehension in this study increased at a slower rate than growth in awareness of grammatical relations, a multi-level study might be productive which would determine how sentence combining and a matching of students' interests would interact to significantly improve reading comprehension. Perhaps several measures that appear to affect reading comprehension could be factored to determine their relative predictive powers. These measures could be some of the following: sentence combining, matching of interests (motivation), risk taking (semantic and syntactic predicting*), and the encouragement of somewhat faster reading to promote the visual spanning of larger perceptual units with their greater load of contextual cues [See Frank Smith's discussion of reading speed (Frank Smith, 1971; p. 226)].

*Semantic-syntactic predicting could take many forms. Younger children could be encouraged to supply a pattern in a cumulative tale that uses repetition with variation. A line of prose or poetry could be interrupted with children supplying the remainder of the line. Cloze procedure could be used as a teaching tool, with the class discussing their reasons for supplying the words they selected for the omitted forms. (See p. 23 of Eugene Jongsma's The Cloze Procedure as a Teaching Technique. Newark, Delaware: The International Reading Association, 1971) Students could have their own free writing used on an overhead with lines covered to encourage anticipation of what should logically follow both semantically and syntactically (See Mark Lester's "The Value of Transformational Grammar in Teaching Composition." In Mark Lester (Ed.) Readings in Applied Transformational Grammar. New York: Holt, Rinehart and Winston, Inc., 1970.)

5. A longitudinal study in the early grades might be useful to determine whether oral practice with sentence combining might prevent the severe lag in reading which seems to follow children from linguistically impoverished backgrounds, a lag which has been so often documented. A new research instrument, the K-Ratio Index, developed by Calvert (1975), shows promise here for measuring syntactic maturity in oral language. Calvert's refinement of Hunt's subordination ratio for greater sensitivity to deletion transformations should give this instrument even greater predictive powers for measuring oral language growth, especially since deletions begin to appear in oral language in the early grades.

6. A study appears needed that would determine whether students having intensive work in free writing would develop the linguistic resources that sentence combining practice appears to encourage. Possibly a three-pronged design similar to Mellon's (1969) would be useful with experimental students involved in sentence combining practice, control students working on usage and other activities similar to those of the control students in this study, and a placebo group working intensively in free writing. Pretests and posttests might include cloze for determining reading comprehension gains, as well as the use of one or more sensitive measures for determining syntactic maturity gains, such as clause length, embeddings per T-unit, etc.

REFERENCES

Amble, B. R. Phrase Reading Training and Reading Achievement of School Children. Reading Teacher, 1966, 20, 210-218.

Anglin, Jeremy M. & Miller, George A. The role of phrase structure in the recall of meaningful verbal material. Psychon. Science, 1968, 10 (10)

Bever, T. G. & Bower, T. G. How to Read without Listening. In Mark Lester (Ed.) Readings in Applied Transformational Grammar. New York: Holt, Rinehart and Winston, Inc., 1970, 305-314.

Blanton, Richard L. Language Learning and Performance in the Deaf. In Sheldon Rosenberg and James H. Koplin (Eds.) Developments in Applied Psycholinguistics Research. New York: The Macmillan Co., 1968, 121-176.

Bormuth, John R. The Cloze Readability Procedure. Elementary English, April 1968, 45, 429-436.

Bormuth, John R. Factor validity of cloze tests as measures of reading comprehension ability. Reading Research Quarterly, Spring 1969, 4, 358-367.

Botel, M. & Granowsky, A. A formula for measuring syntactic complexity: a directional effort. Elementary English, April 1972, 49, 513-516.

Brewer, William F. Is Reading a Letter-by-Letter Process? In James F. Kavanagh and Ignatius G. Mattingly (Eds.) Language by Ear and by Eye. Cambridge: M.I.T. Press, 1972, 359-366.

Burruel, Jose M.; Gomez, Julie; & Ney, James W. Transformational Sentence Combining in a Barrio School. In Ruth Crymes and William E. Norris (Eds.) On TESOL 74. Washington, D.C.: TESOL, 1975, 219-230.

Calvert, Kenneith H. K-Ratio Index. In William T. Fagan, Charles R. Cooper & Julie M. Jensen (Eds.) Measures for Research and Evaluation in the English Language Arts. NCTE Research Foundation. Urbana, Illinois: National Council of Teachers of English, 1975, 9.

Cooper, Charles R. An Outline for Writing Sentence-Combining Problems. English Journal, January 1973, 62, 96-102, 108.

Epstein, W. The influence of syntactic structure on learning. American Journal of Psychology, 1961, 74, 80-85.

Evanechko, Peter; Ollila, Lloyd; & Armstrong, Robert. An Investigation of the Relationships Between Children's Performance in Written Language and Their Reading Ability. Research in the Teaching of English, Winter 1974, 8, 315-326.

Fisher, Kenneth David. An Investigation to Determine if Selected Exercises in Sentence-Combining Can Improve Reading and Writing. Unpublished Doctoral Dissertation. Indiana University, 1973. 74-2586.

Fodor, J. A. & Bever, T. G. The psychological reality of linguistic segments. Journal of Verbal Learning and Verbal Behavior, 1965, 414-420.

Fodor, J. A.; Bever, T. G.; & Garrett, M. F. The Psychology of Language. New York: The McGraw-Hill Book Company, 1974.

Forster, K. I. The effect of syntactic structure on nonordered recall. Journal of Verbal Learning and Verbal Behavior, 1966, 5, 292-297.

Gibbons, Helen D. Reading and Sentence Elements. Elementary English Review, February 1941, 18, 42-46.

Goodman, Kenneth S. Reading: A Psycholinguistic Guessing Game. In Doris Gunderson (Ed.) Language and Reading. Washington, D.C.: Center for Applied Linguistics, 1970.

Goodman, Kenneth S. Theoretically Based Studies of Patterns of Miscues in Oral Reading Performance. U. S. Office of Education, Bureau of Research. Detroit: Wayne State University, 1973. Project No. 9-0375.

Goodman, Kenneth S. Miscues: Windows on the Reading Process. In Kenneth S. Goodman (Ed.) Miscue Analysis: Applications to Reading Instruction. Urbana, Illinois: National Council of Teachers of English, 1973, 3-14.

Graf, Richard & Torrey, Jane W. Perception of Phrase Structure in Written Language. Proceedings of the 74th Annual Convention of the American Psychological Association, 1966, 83-84.

Guthrie, John T. Reading comprehension and syntactic responses in good and poor readers. Journal of Educational Psychology, December 1973, 65, 294-299.

Horton, Raymond Joseph. The Construct Validity of Cloze Procedure: An Exploratory Factor Analysis of Cloze, Paragraph Reading, and Structure-of-Intellect Tests. Unpublished Doctoral Dissertation. Hofstra University, 1973.

Hunt, Kellogg W. Differences in grammatical structures written at three grade levels, the structures to be analyzed by transformational methods. Tallahassee: Florida State University. U. S. Office of Education, Cooperative Research Project 1998, 1964.

Hunt, Kellogg W. Grammatical Structures Written at Three Grade Levels. Research Report No. 3. Urbana, Illinois: National Council of Teachers of English, 1965.

Hunt, Kellogg W. Recent Measures in Syntactic Development. In Mark Lester (Ed.) Readings in Applied Transformational Grammar. New York: Holt, Rinehart and Winston, Inc., 1970, 187-200.

Hunt, Kellogg W. Syntactic Maturity in Schoolchildren and Adults. Monograph of the Society for Research in Child Development (Serial No. 134, Vol. 35, No. 1), February 1970.

Levelt, W. J. M. Hierarchical Chunking in Sentence Processing. Perception and Psychophysics, 1970, 8, 99-103.

Levin, Harry & Kaplin, Eleanor L. Grammatical Structure and Reading. In Harry Levin and Joanna P. Williams (Eds.) Basic Studies on Reading. New York: Basic Books, Inc., 1970, 119-133.

Levin, Harry & Kaplin, Eleanor L. Eye-Voice-Span (EVS) within active and passive sentences. Language nd Speech, September 1968, 11, 251-258.

Levin, Harry & Turner, Elizabeth A. Sentence structure and the eye-voice-span. In Harry Levin, Eleanor Gibson, and James Gibson (Eds.) The Analysis of Reading Skills. Ithaca, New York: Cornell University Press, 1968.

Loban, Walter. The Language of Elementary School Children. NCTE Research Report No. 1. Urbana, Illinois: National Council of Teachers of English, 1963.

Loban, Walter. Oral Language and Learning. In James Walden (Ed.) Oral Language and Reading. Urbana, Illinois: National Council of Teachers of English, 1969.

Loban, Walter. The Limitless Possibilities for Increasing Knowledge about Language. Elementary English, May 1970, 57, 624-230.

MacKinnon, A. R. How Do Children Learn to Read. Vancouver, British Columbia: Clapp Clark, 1959.

Marchbanks, G. & Levin, H. Cues by Which Children Recognize Words. Journal of Educational Psychology, 1965, 56, 57-61.

Marks, Lawrence E. & Miller, George A. The Role of Semantic and Syntactic Constraints in the Memorization of English Sentences. Journal of Verbal Learning and Verbal Behavior, February 1964, 3, 1-5.

McConkie, George W. & Rayner, Keith. An on-line computer technique for studying reading: identifying the perceptual span. In Phil L. Nacke (Ed.) Diversity in mature reading: theory and research. Twenty-second Yearbook of the National Reading Conference, 1973, IV, 119-130.

Mellon, John C. Transformational Sentence-Combining: A Method for Enhancing the Development of Syntactic Fluency in English Composition. NCTE Research Report No. 10. Urbana, Illinois: National Council of Teachers of English, 1969.

Miller, B. & Ney, J. W. Oral drills and writing improvement in the fourth grade. The Journal of Experimental Education, 1967, 36, 93-99.

Miller, B. & Newy, J. W. The effect of systematic oral exercises on the writing of fourth grade students. Research in the Teaching of English, 1968, 2, 44-61.

Miller, George A. The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information. Psychological Review, 1956, 63, 81-97.

Milner, Esther. A Study of Relationships Between Reading Readiness in Grade One School Children and Patterns of Parent-Child Interaction. Child Development, June 1951, 22.

Moffett, James. When Is Discovery Real--And Right? Elementary English, January 1973, 50, 12.

Morton, J. The effects of context upon speed of reading, eye-movements and eye-voice span. Quarterly Journal of Experimental Psychology, 1964, 16, 340-351.

Newman, Anabel P. Later achievement study of pupils underachieving in first grade. Reading Research Quarterly, Apring 1972, VII, 477-508.

Ney, James W. Applied Linguistics in the Seventh Grade. English Journal, 1968, 55, 895-897.

Ney, James W. Notes Towards a Psycholinguistic Model of the Writing Process. Research in the Teaching of English, Summer 1974, 8, 157-169.

Oakan, Robert; Wiener, Morton; & Cromer, Ward. Identification, organization and reading comprehension for good and poor readers. Journal of Educational Psychology, February 1971, 62, 71-78.

O'Donnell, R. C.; Griffin, W. J.; & Norris, R. C. Syntax of kindergarten and elementary school children: a transformational analysis. Research Report No. 8. Urbana, Illinois: National Council of Teachers of English, 1967.

O'Donnell, Roy C. & King, F. J. An Exploration of Deep Structure Recovery and Reading Comprehension Skills. Research in the Teaching of English, Winter 1974, 8, 327-338.

O'Hare, Frank. Sentence-Combining: Improving Student Writing without Formal Grammar Instruction. Research Report No. 15. Urbana, Illinois: National Council of Teachers of English, 1973.

Peltz, Fillmore Kenneth. The effect upon comprehension of repatterning based on students' writing patterns. Reading Research Quarterly, 1973-1974, IX, 603-621.

Poulton, E. G. Peripheral Vision, Refractoriness and Eye Movements in Fast Oral Reading. British Journal of Psychology, 1962, 53, 409-419.

Ramanauskas, Sigita. The responsiveness of cloze readability measures to linguistic variables operating over segments of text longer than a sentence. Reading Research Quarterly, Fall 1972, 8, 72-81.

Reid, Jessie F. Children's comprehension of syntactic features found in some extension readers. In Jessie F. Reid (Ed.) Reading: Problems and Practices. London: Ward Locke Educational, 1972, 394-403.

Rode, Sara S. Development of phrase and clause boundary reading in children. Reading Research Quarterly, 1974-1975, X, 124-142.

Ruddell, Robert B. Effect of the Similarity of Oral and Written Patterns of Language Structure on Reading Comprehension. Elementary English, April 1965, 42, 403-410.

Ruddell, Robert B. Reading Instruction in First Grade with Varying Emphasis on the Regularity of Grapheme-Phoneme Correspondences and the Relation of Language Structure to Meaning. Reading Teacher, May 1966, 19, 653-660.

Ruddell, Robert B. Second and Third Year of a Longitudinal Study of Four Programs of Reading Instruction with Varying Emphasis on the Regularity of Grapheme-Phoneme Correspondences and the Relation of Language Structure to Meaning. U. S. Department of Health, Education and Welfare. Office of Education Cooperative Research Projects, No. 3099 and 78085, 1968.

Samuels, S. Jay. Modes of Word Recognition. In Harry Singer and Robert B. Ruddell (Eds.) Theoretical Models and Processes of Reading. Newark, Delaware: International Reading Association, 1970.

Siler, Earl R. The effects of syntactic and semantic constraints on the oral reading performance of second and fourth graders. Reading Research Quarterly, 1973-1974, IX, 583-602.

Simon, Herbert A. How Big is a Chunk? Science, 1974, 183, 482-488.

Smith, Frank. Understanding Reading. New York: Holt, Rinehart & Winston, 1971.

Smith, Frank. Psycholinguistics and Reading. New York: Holt, Rinehart & Winston, 1973.

Smith, Frank. The Role of Prediction in Reading. Elementary English, March 1975, 52, 305-311.

Smith, Frank & Holmes, Deborah Lott. The Independence of Letter, Word, and Meaning Identification in Reading. Reading Research Quarterly, 1971, 6, 394-415.

Smith, Nila Banton. Research in reading: Trends and Implications. Elementary English, February 1971, 48, 320-327.

Smith, Nila Banton. Early Language Development: Foundations of Reading. Elementary English, March 1975, 52, 399-403.

Smith, William L. The Effect of Transformed Syntactic Structures on Reading. Unpublished doctoral dissertation, University of Georgia, 1968.

Stedman, Nathan Alexander. The Effect of a Curriculum Teaching Syntactic Embedding upon the Reading Comprehension of Fourth-Grade Students. Unpublished dissertation, Florida State University, 1971. 72-10,049.

Strickland, Ruth G. The Language of Elementary School Children: Its Relationship to the Language of Reading of Selected Children, Bulletin of the School of Education, Vol. 38, No. 4. Bloomington, Indiana: Indiana University, 1962.

Strong, William. Sentence Combining: A Composing Book. New York: Random House, Inc., 1973.

Thomas, Owen. Teaching Children about Language. In The Humanity of English. NCTE 1972 Distinguished Lectures. Urbana, Illinois: National Council of Teachers of English, 1972, 57-70.

Venezky, Richard L. & Calfee, Robert C. The Reading Competency Model. In H. Singer and R. B. Ruddell (Eds.) Theoretical Models and Processes of Reading. Newark, Delaware: International Reading Association, 1970.

Vygotsky, Lev. Thought and Language. Translated by Eugenia Hanfmann and Gertrude Vakar. Cambridge, Massachusetts: M.I.T. Press, 1972 (ninth printing).

Wayne State University Miscue Conference. Announcement of preliminary research findings based on the later published study: Theoretically Based Studies of Patterns of Miscues in Oral Reading Performance, Kenneth Goodman, Director. U. S. Office of Education, Bureau of Research. Detroit: Wayne State University. No. 9-0375, 1972.

Weber, Rose-Marie. First-Graders' Use of Grammatical Context in Reading. In Harry Levin and Joanna P. Williams (Eds.) Basic Studies on Reading. New York: Basic Books, Inc., 1970, 147-163.

Weinstein, Rhona & Rabinovitch, M. Sam. Sentence Structure and Retention in Good and Poor Readers. Journal of Educational Psychology, February 1971, 62, 25-30.

Weintraub, Samuel; Robinson, Helen M.; Smith, Helen K.; & Plessas, Gus P. Summary of investigations relating to reading. Reading Research Quarterly, Winter 1972, VII, 2.

Ibid., Spring 1973, VIII, 3.

Weintraub, Samuel; Robinson, Helen M.; Smith, Helen K.;& Roser, Nancy. Summary of investigations relating to reading. Reading Research Quarterly. 1973-1974, IX, 3.

Weintraub, Samuel; Robinson, Helen M.; Smith, Helen K.; Plessas, Gus P.; & Rowls, Michael. Summary of investigations relating to reading. Reading Research Quarterly, 1974-1975, X, 3.

TEST REFERENCES

Tests:

GATES-MACGINITIE READING TEST. Arthur I. Gates & Walter H. MacGinitie. New York: Teachers College Press, 1965.

READING MISCUE INVENTORY. Yetta Goodman and Carolyn Burke. Reading Miscue Inventory Manual. New York: Macmillan, 1972.

Cloze and Miscue Materials:

Johnson, Edna; Sickels, Evelyn R.; & Sayers, Frances Clarke (Eds.) Anthology of Children's Literature, 4th ed. Boston: Houghton Mifflin Co., 1970.

Kennedy, John F. Profiles in Courage. New York: Harper & Brothers, 1956.

Piltz, Albert & Van Bever, Roger A. Discovering Science 6. Columbus, Ohio: Charles E. Merrill Co., 1970.

Pooley, Robert, et al. (Eds.) Good Times in Literature. Glenview, Illinois: Scott, Foresman & Co., 1956.

MacCracken, Helen Dolman, et al. Science through Discovery 3. Syracuse, New York: The L. W. Singer Company, 1967.

Weiss, Bernard J. & Hunt, Lyman C. (Eds.) Riders on the Earth. New York: Holt, Rinehart & Winston, Inc., 1973.