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AUTHOR Laframboise, Kathryn L.

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ABSTRACT

A study is in progress (with posttesting planned for April 1989), which examines whether word processing enhances the particular benefits of sentence-combining practice on the reading comprehension and writing fluency of low-achieving intermediate students. Subjects are 80 low-achieving fourth grade students from a Florida school district, randomly assigned to one of three levels of treatment. The first experimental treatment group is participating in teacher-directed lessons on sentence-combining with independent practice on data files with a word processing program. The second experimental treatment group is receiving the same lessons and exercises, but the independent practice is on worksheets. A control group forms the third group. A clinical study component entails a more in-depth analysis of students' writing and oral retellings of stories. Results will be collected from reading and writing measures, to include written retellings of stories using silent film prompts, two cloze tests, and audiotapes of story retellings. The clinical study component will be reported by means of narrative descriptions and descriptive statistics. The hypotheses for this research predict that the two experimental treatment groups will score significantly higher than the control group in writing fluency. (One table, of types of data to be collected and the manner in which it will be reported, is included. Twenty-two references are attached.) (SR)

The Effects of Sentence-Combining Using Word Processing Technology on the Reading Comprehension and Writing Fluency of Low-Achieving Fourth Grade Students

by

Kathryn L. Laframboise

Paper Presented at the Annual Meeting of the

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The Effects of Sentence-Combining Using Word Processing Technology on the Reading Comprehension and Writing Fluency of Low-Achieving Fourth Grade Students

The psycholinguistic and interactive models of reading provide insight into processes that may explain what occurs during learning while using sentence-combining tasks (Goodman, 1973; Rumelhart, 1977; Samuels & Kamil, 1984; Smith, 1978). According to these models, reading involves the use of various cue systems or knowledge structures that interact during the act of reading to provide information to the reader in order that meaning can be constructed from the text. The skilled reader can comprehend quickly by using only minimal cues from each of the systems. Depending on the model, these cues are described as phonetic, semantic, orthographic, syntactic, lexical or sources of information outside the reader. The reader will backtrack for more cues if those already picked out are not sufficient for the text to make sense. A recent development in the reading model is the interactive-compensatory model proposed by Stanovich (1980). A key concept of this model is that a deficiency in any of the cue systems or at any of the stages of processing may be compensated for by the other knowledge structures. For instance, the skilled reader who is reading text on an unfamiliar topic may rely more heavily on sight vocabulary and phonic, orthographic, and syntactic cues. Similarly, the poor reader who is knowledgeable on a particular subject may still be able to comprehend text on that topic. The compensatory model may help explain a particular disadvantage that confronts the poor reader in the school setting. As the student moves through the grades, it becomes increasingly important to be able to read to learn. The content

subject areas rely on written text to teach new concepts and describe new experiences. The skilled reader can use other knowledge structures to compensate for a lack of topic familiarity. For the poor comprehender, there may not be sufficient information provided by sight vocabulary and syntactic, phonic, and orthographic cues to bring meaning to the text. Of interest to this study is the syntactic cue system. Insofar as the writer's use of syntax is beyond the reader's level of fluency, the reader may be hindered from being able to construct meaning from text.

Sentence-combining is an instructional technique that provides students with practice in the manipulation of various sentence patterns. Kernel sentences, sentences that contain single concepts or relationships, are combined or embedded to produce more complex sentences. Research suggests that working with and producing various language patterns actually raises the level of syntactic fluency and, therefore, increases the ability to use and comprehend various sentence structures (Stotsky, 1975).

With this theoretical basis for the relationship of sentence-combining to reading comprehension and writing fluency, this study examines the particular benefit that sentence-combining provides the reader who is experiencing difficulties in reading comprehension. Sentence-combining provides practice in the use of syntactic structures that are needed to construct meaning from written text. The sentence-combining curriculum was chosen for this study because of its theoretical and research basis indicating that the manipulation of syntactic structures may increase the development of language ability and, therefore, provide reading and writing skills needed by the low-achieving

reading student (Hunt & O'Donnell, 1970; Neville & Searls, 1985; Stotsky, 1975). The addition of word processing to sentence-combining tasks would seem to have some unique qualities that are particularly beneficial to the poor comprehender in reading. Research into the effects of word processing on the quality and quantity of writing is meager at this point in time. It is suggested that word processing has more than just a motivating influence and may actually enhance language learning by influencing the cognitive processes of language production. By easing the strains on the limits of the working memory caused by the many demands of the writing process, word processing technology may provide a means to free the memory resources for higher level thinking processes (Daulte, 1985). Research is essential for a more complete understanding of the role of word processing technology in written language production and comprehension.

The purpose of this study is to examine whether word processing enhances the effects of sentence-combining practice on the reading comprehension and writing fluency of low-achieving intermediate students. Writing is, by its nature, a process in addition to being a product. This study is examining various measures of reading and writing that will aid in the understanding of what occurs during the acts of reading and writing. This research includes two components, a quasi-experimental study and a clinical study component. It is hoped that the combination of group measures and in-depth analysis of the oral and written language of randomly selected students will provide insights into language behaviors that will add to the understanding of the reading-writing connection and

the possible facilitating effects of word processing in the writing process.

At present, the research is on-going. Pretesting of subjects was conducted in September and early October, 1988. The experimental treatment is currently being implemented, and posttesting is planned for April, 1989.

Method

Subjects

Subjects in this study are 80 fourth grade students in the E.C.I.A. Chapter One Basic program in a Florida school district serving 30,400 students. E.C.I.A. Chapter One Basic is a program, established through the Education Consolidation and Information Act, which offers supplementary reading and/or mathematics instruction and curricular materials to students that meet program criteria. Schools qualify for funding for the E.C.I.A. program based on the number of students in the school who are eligible for the federally subsidized lunch program. County E.C.I.A. guidelines for student eligibility include scores below the national median in both reading and mathematics on a standardized achievement test and screening by a school-based team of other factors, such as, below grade-level basal placement, scores on the state minimum competency tests and basal level tests, and previous attendance at summer school. Classes are self-contained with between 10 and 17 students.

Design

Quasi-experimental study. The study includes six fourth grade E.C.I.A. classes, each in a separate school. Classes were selected for the study in the following way. All schools in the school district that

had the E.C.I.A. program were included in the study if they met specified criteria. Criteria for teachers included a minimum of three years teaching experience. All teachers had to have taught in the intermediate grades in the same school district during the previous school year. Teachers had to judge themselves as possessing basic computer skills on a teacher survey that was conducted prior to the study. Initially classes in eleven separate schools were screened for inclusion in the study. Four schools were eliminated because there was either a combination of two grade levels in the classroom or there was a teacher on a temporary contract. The remaining seven classes all met the teacher criteria, and one was used for a pilot study during the summer school session preceding the term in which the study was initiated. Teachers of the remaining six classes agreed to the requirements of the study before being assigned to treatment group.

The six classes were stratified using class averages in reading comprehension, based on scores from the Spring, 1988 administration of the Stanford Achievement Test (SAT). The three schools in the high and in the low strata were then randomly assigned to three levels of treatment. Treatment includes two versions of the experimental curriculum and a control condition. The first experimental treatment group is participating in teacher-directed lessons on sentence-combining with independent practice that is on data files used with a word processing program. The second experimental treatment group is receiving the same lessons and exercises, but the independent practice is done on worksheets. The control group is following the county reading/language arts curriculum, which includes a basal reading series, an English text, and

process writing. Teachers in the two experimental groups have two 30 to 40 minute sentence-combining lessons each week and substitute these lessons for other writing activities in the language arts block. There are a total of 28 lessons. Time on task for language arts is judged to be equal for all groups.

Clinical study component. From each of the three treatment groups, three students were selected for a clinical study component, which entails a more in-depth analysis of students' writing and oral retellings of stories. Each teacher provided the researcher with a list of students who were reading in the second grade basal or above, whose absences averaged no more than two days each month, who were relatively stable within the school and would likely not move within the period of the study, and who did not regularly miss a portion of the class due to a conflict of schedule. From this list of students, the researcher randomly selected the nine students for the clinical study component.

Materials

Pilot study. During the 1988 summer school session, the researcher worked in a fourth grade classroom, three days per week for five weeks. During that time, the researcher sampled various lessons in the curriculum, observed lesson difficulty and time requirements for the computer tasks, and developed computer training materials that would be used with students in the word processing experimental treatment prior to the initiation of the research curriculum. In addition, procedures were developed for collecting the oral story retellings, and the film prompts were used with this and one other fourth grade class to examine the

ability of the prompts to stimulate writing samples of adequate and comparable lengths.

Experimental curriculum. All classrooms in both the experimental and control groups have a computer that is used regularly by the students. Computer classrooms each received an additional four computers and a printer through a grant from the Florida Center for Instructional Computing at the University of South Florida. The sentence-combining curriculum, however, is being used only on four computers and is incompatible with the school's system.

The curriculum that has been implemented in the study is based on sentence-combining lessons developed by Hunt and O'Donnell (1970). Permission to use the lessons and also the cloze testing materials (Stedman, 1972), which are described in the section describing data sources, was granted by the respective researchers. The lessons require students to combine kernel or basic sentences in a variety of syntactic patterns. Lessons start with practice combining pairs of sentences and progress to groups of eight to twelve sentences. The open method of sentence-combining, developed by Strong (1973), in which sentences are presented without signals to indicate the type of transformation or embedding, is used. Beginning in lesson four, students also practice identifying the kernel sentences or ideas that make up combined sentences.

Two versions of the experimental curriculum are being used. Lessons were developed that are teacher-directed and include an overview of the lesson, content presentation with group discussion, and group guided practice. Independent practice for one group consists of paper and pencil exercises. The second group works through exercises that are contained in

data files to be used with the Bank Street Writer word processing program. Both groups of students are working in pairs since the oral language feedback is considered an integral part of the sentence-combining activity (Neville & Searls, 1985; O'Hare, 1973; Strong, 1986).

Data Sources

All tests are being administered by the researcher and two graduate students who are also experienced teachers. Protocols for each reading and writing measure and for the collection of the oral language and writing samples of the subjects in the clinical study component were developed and are used by each test administrator.

Reading and writing measures are being collected using the following procedures. Four soundless films were used as story prompts for written retellings of the story. This type of writing prompt was chosen because it allows the students to concentrate on the production of language rather than the creation of ideas. The film prompts are being counterbalanced across test administrations. Writing samples are being analyzed for mean number of words per T-unit. A T-unit is defined as one main clause plus any subordinate clauses that are embedded in it. The reliability of this measure of syntactic fluency has been established by Hunt (1965, 1970) and Loban (1976).

Cloze tests are being used as pre- and posttest reading measures. Stedman (1972) developed two cloze passages for the Hunt and O'Donnell study (1970). The Stedman cloze tests differ from traditional cloze, which has a nth word deletion procedure that randomly removes content words as well as function words Stedman's tests systematically delete pronouns, relatives, prepositions, conjunctions, articles, and adverbs introducing

clauses. Content words are removed only if an understanding of syntactic structures is required for their reinsertion. Stedman determined that the cloze tests examined the subjects' comprehension of structures of embeddings but did not test only the specific types of embeddings taught in the Hunt and O'Donnell curriculum, upon which the curricular materials in the present study are based. Stedman controlled for interrater reliability in scoring the cloze tests by providing the students with a list of words that could be used in the blanks and then provided raters with a list of acceptable answers.

Since one might argue that a test with this type of deletion pattern will favor students in a curriculum designed to enhance syntactic fluency, a second version of the test was also developed. All words were reinstated in the Stedman passages. First and last sentences were left intact, and beginning with the second sentence every fifth word was deleted This procedure produced two cloze tests to be used as a more general measure of reading comprehension (Bormuth, 1969; Rankin, 1978; Rankin & Thomas, 1980).

During the pretesting, each class took one version of the Stedman cloze test, which used the deletion of function words. Reading comprehension scores on the Stanford Achievement Test that was administered in the county during Spring, 1988, will also be used as a covariate for the final statistical analyses. Posttesting will be conducted in April, 1989, and each class will take a second Stedman test plus the traditional form of the cloze. The cloze tests are being counterbalanced across test administrations.

Finally, oral and written language of the nine subjects in the clinical study component are being sampled in the following ways. Either Jumanji or The Wreck of the Zephyr, picture storybooks by Chris Van Allsburg, are read individually to the subject. The subject is then asked to retell the story and is audiotaped. The tapes are being transcribed and analyzed for words per T-unit using procedures established by Loban (1976) and for number and types of embeddings. In addition, each subject is being given a written story comprised of 30 kernel or basic sentences. The test administrator reads the story aloud while the subject reads it silently. The subject is directed to rewrite the story by combining sentences using as few sentences as possible, while including all the ideas of the original story. This focused writing task will also be analyzed for mean T-unit length and number and types of embeddings.

Table 1 presents the type of data that will be collected for each of the study components and the manner in which it will be reported. Three analyses of covariance will be performed using pretest measures as the covariate. Scores on the two versions of the cloze test and the mean number of words per T-unit on the free writing samples will be compared for the word processing sentence-combining group, the non-word processing sentence-combining group, and the control group.

The oral language and writing tasks of the clinical study component will be reported by means of narrative descriptions and descriptive statistics. A more complete examination of the performance of the nine selected students will be reported for three tasks. The mean number of embeddings per T-unit, the types of embeddings, and the mean number of

Table 1

Data To Be Collected and Types of Analyses for the Two Components of the Study

Test	Measure	Statistical Analysis
	Quasi-experimental Component - Pretest	
SAT	raw score	(covariate)
cloze	raw score	(covariate)
free writing	mean T-unit length	(covariate)
	Quasi-experimental Component - Posttest	
cloze - structural	raw score	ANCOVA
cloze - traditional	raw score	ANCOVA
free writing	mean T-unit length	ANCOVA
	Clinical Study Component - Pretest and Posttest	
free writing	T-unit length	mean
	# embeddings/T-unit	mean
	types of embeddings	narrative description frequency distribution

Table 1 (cont'd.)

Test	Measure	Statistical Analysis
focused writing	T-unit length	mean
	# embeddings/T-unit	mean
	types of embeddings	narrative
		description
		frequency
		distribution
oral language task		
	T-unit length	mean
	# embeddings/T-unit	mean
	types of embedding	narrative
		description

words per T-unit will be reported for the free writing sample, the focused writing task, and the oral story retellings.

Expected Results

The following is a brief discussion of the expected results and implications of this study. The design of the study was developed in order to examine whether word processing enhances the effects of sentence-combining practice on the reading comprehension and writing fluency of low-achieving intermediate students. The sentence-combining curriculum is based on previous research that showed significant

differences in favor of the experimental treatment groups on free writing tasks, focused writing tasks, and cloze tests with structural words deleted. Further analysis of the results indicated that the effects may have been greater on low-achieving students than on students achieving at or above grade level. The design of this study is intended to replicate those findings.

The word processing treatment is added to the present study in order to examine the facilitating effects of word processing as an instructional tool. The three levels of treatment will allow comparisons to determine whether word processing is as effective or more effective in presenting certain types of writing activities.

Because this study examines the effects of writing tasks on processes that may influence reading, two types of reading measures are being used. The cloze test with structural word deletions is being used as a measure of growth in the comprehension of syntactic patterns that may represent the reader's ability to use syntax as a cue when reading. If this were the only type of reading measure, one might argue that the experimental curriculum preteaches the test or that the curriculum favors this type of reading skill to the possible detriment of other areas of reading skills. The traditional cloze is, therefore, being used as a more general measure of reading comprehension. In addition, the two forms of the posttest cloze would seem to be more highly correlated to each other on prior knowledge of content and specific test-taking factors than the syntactic cloze and a standardized reading achievement test (Auerbach, 1971; Carroll, 1972; Simons, 1971).

The hypotheses for this research predict that the non-word processing sentence-combining treatment group will score significantly higher than the control group in writing fluency measured by the mean number of words per T-unit on free writing samples and in reading comprehension measured by a traditional cloze test and a cloze test with functional words deleted. If these expected results occur, then it may be concluded that the sentence-combining and kernel identification, which was based on the earlier research, has successfully transferred to this sample of subjects and at this time. The hypotheses also predicted that the word processing sentence-combining treatment group will score significantly higher than the non-word processing sentence-combining group and the control group in writing fluency measured by the mean number of words per T-unit on free writing samples and in reading comprehension measured by a traditional cloze test and a cloze test with functional words deleted. Examination of these hypotheses will determine whether the use of word processing is as effective or more effective than paper and pencil exercises in providing practice in the manipulation of syntactic structures during writing activities. Because other variables, such as time on task and teacher effects, have been controlled, it will be easier to draw conclusions about the possible enhancing effects of word processing.

Finally, the clinical study component is included to provide a more in-depth view of the students' language and how the curriculum may affect it. During the period of the study, the researcher has regularly observed the six classrooms. The informal nature of these observations are not reliable in predicting possible outcomes; however, the enthusiasm and concentration of the students in the computer classes is observable. The

students' data files and worksheets are examined periodically, and it seems that the students working on the word processors are more successful in the tasks and write more varied sentence combinations. It is hoped that the measures included in the clinical study component will help provide explanations for these observations.

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