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ABSTRACT

To determine whether a comprehensive, cooperative learning approach can be used effectively in elementary reading and writing instruction, a study evaluated the Cooperative Integrated Reading and Composition (CIRC) program. Experimental subjects, 11 third- and fourth-grade CIRC classes, worked in heterogeneous learning teams for all reading, language arts, and writing activities over a 12-week period. The control group consisted of 10 regular third- and fourth-grade classes. Overall, results supported the effectiveness of the CIRC program on all target objectives except language mechanics and writing ideas. Findings ascribed the effects on (1) spelling to the partner spelling practice; (2) writing organization and language expression to the integrated language arts/writing component; and (3) reading vocabulary and reading comprehension to basal-related activities such as the teaching of story grammars, partner reading, and mastery-oriented story comprehension practice. Thus, analyses showed that student achievement in reading and writing can be increased if state-of-the-art principles of classroom organization, motivation, and instruction are used in the context of a cooperative learning program. Results also indicated that standardized measures of skills such as reading comprehension and reading vocabulary can be affected by treatments that simultaneously address student motivation, classroom management, curriculum, and metacognitive activities. (JD)

Center for Research On Elementary & Middle Schools

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A COMPREHENSIVE COOPERATIVE LEARNING APPROACH TO ELEMENTARY READING AND WRITING: EFFECTS ON STUDENT ACHIEVEMENT

Nancy A. Madden, Robert J. Stevens and Robert E. Slavin

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The Center

The mission of the Center for Research on Elementary and Middle Schools is to produce useful knowledge about how elementary and middle schools can foster growth in students' learning and development, to develop and evaluate practical methods for improving the effectiveness of elementary and middle schools based on existing and new research findings, and to develop and evaluate specific strategies to help schools implement effective research-based school and classroom practices.

The Center conducts its research in three program areas: (1) Elementary Schools; (2) Middle Schools, and (3) School Improvement.

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This program focuses on improving the organizational performance of schools in adopting and adapting innovations and developing school capacity for change.

This report, prepared by the Elementary School Program, describes the first field-experimental evaluation of a comprehensive cooperative learning program for teaching reading and writing in elementary schools.

A Comprehensive Cooperative Learning Approach to Elementary Reading and Writing: Effects on Student Achievement

Abstract

This study evaluated a comprehensive cooperative learning approach to elementary reading and writing instruction, Cooperative Integrated Reading and Composition (CIRC). In CIRC, students worked in heterogeneous learning teams for all reading, language arts, and writing activities. In reading they worked with partners during followup times on partner reading, vocabulary, decoding, and spelling practice, and story grammar, prediction, and story summary activities based on basal stories. Students worked in teams on structured reading comprehension and language arts activities, and engaged in peer editing in writing. A twelve-week experiment compared 11 grade 3-4 CIRC classes to 10 matched control classes. Random-effects nested ANOVA's on adjusted posttests indicated significantly higher achievement in CIRC than control classes on standardized Reading Comprehension, Reading Vocabulary, Language Expression, and Spelling scales, and on ratings of Organization in writing samples.

Acknowledgments

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Introduction

Over the past fifteen years, a substantial body of research has established that when students work in four-member, heterogeneous learning groups and are rewarded based on the learning of all group members, students gain in academic achievement (Sharan, 1980; Slavin 1983a,b). These cooperative learning methods have been studied in grades two through college, in urban, rural, and suburban locations, and in such subjects as mathematics, social studies, and language arts.

Early cooperative learning methods, such as those described by Aronson, Blaney, Stephan, Sikes & Snapp (1978), Johnson & Johnson (1975), Sharan and Sharan (1976), and Slavin (1983c) were designed primarily as supplements to traditional classroom activities and curricula, but recently comprehensive instructional programs based on cooperative activities have been developed. Among these are such programs as Finding Out/Descubrimiento, a discovery-oriented science and mathematics program (DeAvila & Duncan, 1984), and Team Assisted Individualization, a mathematics program which combines cooperative learning and individualized instruction (Slavin, 1985).

More than fifty high-quality field experiments involving durations of at least four weeks have evaluated cooperative learning methods, and the findings consistently support the use of those which use specific group incentives (such as recognition or grades) based on the sum of the group members' individual learning performances, such as the group members' average quiz scores (Slavin 1983a,b).

However, research and development of cooperative learning methods has been conspicuously neglected in two of the most essential subjects in the elementary school curriculum: Reading and writing. The reasons for this have to do with the nature of these subjects. Reading is typically taught using homogeneous reading groups (Hiebert, 1983), making problematic the use of the heterogeneous learning groups central to all cooperative learning methods, and writing has been viewed as a personal, individual task.

Although much research has established the positive effects of cooperative learning on learning of language mechanics skills (e.g., Slavin & Karweit, 1981), cooperative learning methods developed for these and other skills-related objectives cannot be directly transferred to writing. On the other hand, writing process models (e.g., Elbow, 1973; Graves, 1983; Calkins, 1983) have introduced means of using structured peer response groups, peer editing, and other ways of having students help one another formulate, draft, evaluate, and revise compositions. However, little methodologically adequate research has examined such writing process methods at the elementary level (see Caplan & Keech, 1980; Hillocks, 1984).

Research Plan

The present research is intended to develop and evaluate a comprehensive cooperative learning model for the teaching of reading and writing in the upper elementary school grades (initially, grades 3-4). The first step in the overall plan is to develop a complex model based both on principles of cooperative learning and on

state-of-the-art knowledge of effective practices in the teaching of reading and writing. After development and pilot testing, the second step is to evaluate the full model in a field experiment in comparison to untreated control groups. If the full program is effective, component analyses will then be conducted to isolate individual variables responsible for the overall effects.

This strategy of developing comprehensive programs and then disassembling them in component analyses, rather than testing one variable at a time, is based on a theory that elements of classroom organization are multiplicatively related to student achievement (Slavin, 1984, 1986). To have measurable effects on achievement variables not specifically keyed to the objectives being taught (such as standardized tests), multiple elements may have to be addressed simultaneously. In research on reading comprehension, where many researchers have questioned whether treatment effects on standardized reading comprehension scales are even possible (Paris, Cross, & Lipson, 1984; Johnston, 1984), the need to first establish treatment effects for a complex program and only then conduct component analyses seems especially great. For example, one of the few methodologically adequate, long-term studies which have found positive effects on standardized reading measures used a complex, comprehensive approach (Anderson, Evertson, & Brophy, 1979).

The instructional intervention developed and evaluated in this program of research is called Cooperative Integrated Reading and Composition, or CIRC. This paper reports the results of the first

field experiment conducted to evaluate the achievement results of the full CIRC program.

Program Rationale and Overview

The CIRC program consists of three principal elements: Basal-related activities, direct instruction in reading comprehension, and integrated language arts/writing. In all these activities, students work in heterogeneous learning teams. All activities follow a regular cycle that involves teacher presentation, team practice, peer pre-assessment, additional practice, and testing. The major components of the CIRC program and rationales for them are described below.

Reading Groups. Students are assigned to reading groups according to their reading level, as determined by their teachers.

Teams. Students are assigned to pairs (or triads) within their reading groups, and then the pairs are assigned to teams composed of partnerships from two reading groups. For example, a team might be composed of two students from the top reading group and two from the low group. Team members receive points based on their individual performances on all quizzes, compositions, and book reports, and these points are contributed to form a team score. Teams that meet an average criterion of 95% on all activities in a given week are designated "superteams" and receive attractive certificates; those which meet an average criterion of 90% are designated "greatteams"

and receive smaller certificates. As noted earlier, research on the use of heterogeneous teams which are rewarded on the basis of their members' learning has established the instructional effectiveness of this approach (Slavin, 1983a,b).

Basal-Related Activities. Students use their regular basal readers. Basal stories are introduced and discussed in teacher-led reading groups that meet for 20-30 minutes each day. During these groups, teachers set a purpose for reading, introduce new vocabulary, review old vocabulary, discuss the story after students had read it, and so on. Presentation methods for each segment of the lesson are structured. For example, teachers are taught to use a vocabulary presentation procedure that requires a demonstration of understanding of word meaning by each individual, a review of methods of work attack, and repetitive oral reading of vocabulary to achieve fluency. Story discussions are structured to emphasize such skills as making and supporting predictions and identifying the problem in a narrative.

After stories are introduced, students are given a story packet, which lays out a series of activities for students to do in their teams when they are not working with the teacher in a reading group. The sequence of activities is as follows:

a. Partner Reading. Students take turns reading the story aloud with their partners, alternating readers after each paragraph. They read the same story twice, correcting one anothers' errors.

Paired reading has been found to contribute to decoding and to

comprehension of narratives (Samuels, 1979). Also, the partner reading gives students a great deal of oral reading practice and enables the teacher to assess student performance (by listening in) without having to have students read aloud in a reading group, wasting the time of the other students in the group.

b. Story Grammar and Story Related Writing. Students are given questions related to each narrative story that emphasize the story grammar. Halfway through the story, they are instructed to stop reading and to identify the characters, the setting, and the problem in the story, and to predict how the problem will be resolved. At the end of the story, students respond to the story as a whole and write a few paragraphs on a topic related to the story (for example, they might be asked to write a different ending to the story). Research on reading comprehension has indicated the importance of students' learning story grammars (Fitzgerald & Spiegel, 1983; Meyer, 1977; Stein & Glenn, 1977) and of making predictions based on partial information about stories (Palincsar & Brown, 1984).

c. Words Out Loud. Students are given a list of new or difficult words used in the story which they have to be able to read correctly in any order without hesitating or stumbling. Students practice these word lists with their partners or other teammates until they can read them smoothly. This activity helps students gain automaticity in decoding critical words (Rosenshine & Stevens, 1985; Samuels, 1981).

d. Word Meaning. Students are given a list of story words which are new to their speaking vocabularies and asked to look them up in a dictionary, paraphrase the definition, and write a sentence for each that shows the meaning of the word (i.e., "An octopus grabbed the swimmer with its eight long arms," not "I have an octopus.")

e. Story Retell. After reading the story and discussing it in their reading groups, students summarize the main points of the story to their partners.

f. Spelling. Students pretest one another on a list of spelling words each week, and then work over the course of the week to help one another master the list. Students use a "disappearing list" strategy in which they make new lists of missed words after each assessment until the list disappears and they can go back to the full list, repeating the process as many times as necessary.

Partner Checking. After students complete each of the activities listed above, their partners initial a form on the cover of the story packet indicating that they have completed and/or achieved criterion on that task. Students are given daily expectations as to the number of activities to be completed, but they can go at their own rate and complete the activities earlier if they wish, creating additional time for independent reading (see below).

Tests. At the end of three class periods, students are given a comprehension test on the story, asked to write meaningful sentences for each vocabulary word, and asked to read the word list aloud to

the teacher. Students are not permitted to help one another on these tests. The test scores and evaluations of the story related writing are major components of students' weekly team scores.

Direct Instruction in Reading Comprehension. One day each week, students receive direct instruction in reading comprehension skills, particularly finding main ideas, based on a step-by-step curriculum designed for this purpose. After each lesson, students work on reading comprehension worksheets and games as a whole team, first gaining consensus on one set of worksheet items and then assessing one another and discussing any remaining problems on a second set of items. Recent research indicates that reading comprehension can be effectively taught as a skill separately from basal instruction (e.g., Palinscar & Brown, 1984; Paris, Lipson, & Wixson, 1983; Stevens, 1985).

Integrated Language Arts and Writing. During language arts periods, teachers use a language arts/writing curriculum specifically developed for the project. In it, students work as teams on language arts skills which lead directly to writing activities. The emphasis of this curriculum is on writing, and language mechanics skills are introduced as specific aids to writing rather than as separate topics. For example, students study modifiers and then write descriptive paragraphs emphasizing their use, and study quotation marks before writing dialogue. On all writing assignments students draft compositions in consultation with peers, and then edit one anothers' work using peer editing forms emphasizing both the

content of the composition and its grammatical and mechanical correctness. Students then revise their completed compositions on the basis of this peer feedback. The peer editing forms begin very simply, but become increasingly complex as students cover successive skills. Writing process models using peer response groups and a sequence of planning, drafting, editing, and revision have been found to be effective in previous research (Hillocks, 1984), although little of this research has been done at the elementary level.

Independent Reading. Students are asked to read a trade book of their choice for at least twenty minutes every evening. Parents initial forms indicating that students have read the required time, and students contribute points to their teams if they submit a completed form each week. Students also complete at least one book report every two weeks, for which they also receive team points. Independent reading and book reports replace all other homework in reading and language arts. If students complete their story packets or other activities early, they can also read their independent reading books in class.

Method

Subjects and Design

The subjects were 461 third- and fourth-grade students in 21 classes in a suburban Maryland school district. The eleven experi-

mental classes in six schools were matched on California Achievement Test Total Reading scores with ten classes in four control schools. Experimental and control teachers volunteered to participate, with control teachers having an understanding that they would receive all materials and training in the fall following the conclusion of the study. The treatments were implemented over a 12-week period during the Spring semester, 1985.

Treatments

A. Control. Control teachers continued to use their usual methods and curriculum materials, which usually consisted of a three-reading-group model with workbooks during followup time and traditional language arts/writing instruction given to the whole class.

B. Cooperative Integrated Reading and Composition (CIRC). The CIRC program was implemented as described above. Teachers were trained in two three-hour sessions and were then visited by project staff (particularly in the early weeks of the program) who monitored program implementation and answered teachers' questions.

Measures

A. Achievement Pretests. To adjust for students' initial performance levels, standardized test scores from district records were used as covariates in all analyses. The scores used were Total Reading and Total Language scale scores from the California Achievement Test. These were administered during the Fall of grade 3; thus

third graders' pretests were recent, but fourth graders' were a year old. The pretest scores were transformed to z-scores separately for each grade so that data from both grades could be combined. Also, writing samples administered at the start of the experiment were used as covariates in addition to Total Reading and Total Language in all analyses of writing posttests.

B. Standardized Posttests. At the end of the experiment, all students were administered the Reading Comprehension, Reading Vocabulary, Spelling, Language Expression, and Language Mechanics scales of the California Achievement Test, Form D. Third graders took Level 14 and fourth graders took Level 15. Raw scores from these scales were transformed to z-scores separately for each grade to enable combining scores across grades.

C. Writing Samples. At pre- and posttesting, students were asked to complete a writing sample in response to probes designed to give them a specific audience and purpose for writing. The probes used were adapted from those developed and field tested for the California State Department of Education by a panel of writing experts led by Doris Prater of the University of Houston. The pre- and post-test probes are presented below.

Pretest Probe:

IMAGINE THIS. Your teacher has decided to have the class take a field trip this spring. Your teacher has asked all of the students in the class to make suggestions about where to go on the trip. Select a place that you think your class would like to visit for a day. Write a note to your teacher. Give the name of the place you have picked. Tell the reasons you think it is a good place for a field trip.

Posttest Probe:

IMAGINE THIS. You have met a girl from China near your school. She speaks English, but she does not know anything about schools in America. Tell her about your school building. Tell her how the building looks on the outside and inside. Tell her about your teacher and your classmates.

The classroom teacher was asked to read the probes to the class to make sure that all students understood the task.

The probes were scored using an analytic scoring procedure developed as the probes were designed and field-tested. Analytic as opposed to holistic scoring procedures were used so that content and mechanics skills in writing could be separately assessed. Each sample was scored on a scale from 1 to 3 on two content variables -- ideas and organization -- and on mechanics skills such as punctuation/capitalization, spelling, usage/word choice, and syntax. Scores on the mechanics skills were combined to form one scale.

Four raters, uninformed as to the purpose or design of the experiment, scored pretest and posttest samples on each of these variables. Because of the time-consuming nature of the scoring procedures, only one sample in four was scored, with the first, fifth, ninth, etc. students in alphabetical order in each class serving as a subsample for the writing analyses. Each writing sample was rated by two raters. After the individual ratings were made, the two raters conferred, discussing and resolving any differences. The agreed-upon scores formed the data.

Raters were individually trained in the use of the analytic scoring system until their scores matched established ratings for the training essays 95% of the time on each variable. Training took approximately three hours. Reliability of the ratings, calculated during the actual scoring of samples, ranged from 83% to 97% agreement, with a mean reliability of 94%.

Analyses

The data were analyzed in two ways. First, analyses of covariance were conducted using the individual student as the unit of analysis. For the standardized posttests, Total Reading and Total Language scores served as covariates in all analyses. For the writing samples, the same scores were used as covariates in combination with the pretest for each respective posttest.

Second, posttest scores adjusted for pretests were used in random-effects nested analyses of variance, which are essentially equivalent to class-level analyses (Glass & Stanley, 1970; Hopkins, 1982). The nested analyses tested the mean square for treatment against that for classes within treatments, with degrees of freedom associated with the number of classes, not the number of students. The nested analyses are conservative tests from which generalizations to similar samples can be made, while results statistically significant only at the individual level cannot be generalized to other settings with as much confidence (see Slavin, 1983d).

Results

Pretest Differences

As noted earlier, experimental and control classes were initially matched on California Achievement Test Total Reading scores. No pretest differences were found on this variable. However, individual-level analyses of variance revealed statistically significant pretest differences on Total Language ($F=9.13$, $p<.003$) and on the pretest writing samples for Mechanics ($F=10.61$, $p<.002$). Both of these differences favored the control group.

Standardized Posttests

Individual-level analyses of covariance found statistically significant differences favoring the experimental group on four of the five standardized scales, Reading Comprehension ($F=9.54$, $p<.002$), Reading Vocabulary ($F=8.65$, $p<.003$), Language Expression ($F=13.25$, $p<.001$), and Spelling ($F=15.20$, $p<.001$). Results were in the same direction for Language Mechanics, but were not statistically significant ($F=2.91$, $p<.089$). Degrees of freedom for all individual-level analyses were one and 457. Nested (class-level) analyses also found statistically significant differences on the same four variables. Degrees of freedom for the nested analyses were one and 19. These results are summarized in Table 1.

Table 1 also presents estimated grade equivalent differences between experimental and control groups, after adjustments for pretests. These estimates were derived using norms from technical bul-

letins for the California Achievement Test. They show adjusted differences of 34% to 71% of a grade equivalent for the statistically significant differences on standardized measures.

Tables 1 and 2 Here

Writing Samples

Table 2 summarizes the treatment effects for the writing samples. Statistically significant differences favored the experimental group in Organization ratings ($F=9.37$, $p<.003$), and these effects were also significant in the nested analyses ($F=6.29$, $p<.021$). No differences were found for Mechanics, paralleling the results for the standardized Language Mechanics scales, or for Ideas ratings.

Discussion

Overall, the results of the experiment supported the effectiveness of the CIRC program on all target objectives except language mechanics and writing ideas. The failure to affect language mechanics was not unanticipated, as the language arts component of the program placed a greater emphasis on writing organization and content and language usage (assessed by the language expression scale) than on isolated language mechanics skills. However, it is hoped that in longer applications of the program the weaving together of language mechanics and writing instruction will lead to a more substantial gain in mechanics skills, especially as expressed in writing. Also, the possibility exists that substantial pretest differences in Total Language favoring the control group may explain the failure to find differences on this variable.

Because the teachers in the experimental group were volunteers and were then matched with teachers in other schools, they may have differed in motivation to participate and might therefore have been better teachers. However, the control teachers were recruited in the same way as the experimental teachers and were offered the program training and materials the following Fall, so motivation to use a new program may be considered equivalent across the two groups. Still, studies using random assignment of teachers need to be conducted in the future.

The difficulty in interpreting a study of a complex program is that any number of factors could account for program effects. In

this study, it is reasonable to ascribe the effects on spelling to the partner spelling practice. The Writing Organization and Language Expression effects can probably be attributed to the integrated language arts/writing component, but students also did a great deal of writing as part of their basal related activities, especially in the story related writing component. The effects on Reading Vocabulary and Reading Comprehension may be due to the basal-related activities (such as the teaching of story grammars, partner reading, and mastery-oriented story comprehension practice), to direct instruction in reading comprehension skills, or to the daily 20-minute independent reading assignment. Component analyses to be conducted in the next stages of this program of research will decompose the full program to better understand the origin of its effects.

This study demonstrates that if state-of-the-art principles of classroom organization, motivation, and instruction are used in the context of a cooperative learning program, student achievement in reading and writing can be increased. In particular, the study demonstrates that standardized measures of such skills as reading comprehension and reading vocabulary can be affected by treatments simultaneously addressing student motivation, classroom management, curriculum, and metacognitive activities. Given the pessimism among many reading researchers that standardized reading test scores (as opposed to measures more closely related to the experimental treatments) can be measurably increased (Paris et al., 1984; Johnston, 1984), these findings are particularly important. Indeed, the per-

vasiveness of the study outcomes on standardized measures not related in any way to the CIRC curriculum is surprising given the brevity of the intervention (12 weeks). This study indicates that cooperative learning can be used effectively in elementary reading and writing, but a long road lies ahead to refine the methods and to understand the separate effects of their component parts.

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Table 1

Means, Standard Deviations, and Analyses:
Standardized Achievement Measures

	CIRC.		CONTROL			
	$\bar{x}$	(SD)	$\bar{x}$	(SD)		
					ANOVA's (d.f.=1,459)	
PRETESTS*					F	p<
Total Reading	-.056	(.941)	.053	(1.051)	1.38	ns
Total Language	-.143	(.943)	.136	(1.034)	9.13	.003
N		225		236		
					ANCOVA's (d.f.=1,457)	
POSTTESTS*					F	p<
Reading Comprehension	.045	(.971)	-.043	(1.025)	9.54	.002
Reading Vocabulary	.024	(.981)	-.024	(1.017)	8.65	.003
Language Expression	.057	(1.007)	-.054	(.991)	13.25	.001
Language Mechanics	-.006	(1.020)	.005	(.981)	2.91	.089
Spelling	.085	(1.029)	-.081	(.965)	15.20	.001
N		225		236		
					Nested (Class-Level) Analyses (d.f.=1,19)	
ADJUSTED POSTTESTS*					F	p<
Reading Comprehension	.100	(.699)	-.095	(.668)	4.85	.040
Reading Vocabulary	.091	(.665)	-.087	(.643)	4.62	.045
Language Expression	.122	(.702)	-.116	(.720)	4.45	.048
Language Mechanics	.062	(.803)	-.059	(.733)	1.44	ns
Spelling	.141	(.788)	-.135	(.749)	11.29	.003
N		225		236		

ADJUSTED POSTTESTS IN GRADE EQUIVALENTS			Difference
Reading Comprehension	5.67	5.26	.41
Reading Vocabulary	5.28	4.94	.34
Language Expression	6.25	5.69	.56
Language Mechanics	6.81	6.49	.32
Spelling	6.22	5.51	.71

* Table entries are in z-scores.

Table 2

Means, Standard Deviations, and Analyses:
Writing Samples

	CIRC		CONTROL			
	$\bar{x}$	(SD)	$\bar{x}$	(SD)	ANOVA's	
					F	p<
PRETESTS						
Total Reading	-.058	(.923)	.058	(1.068)	<1	ns
Total Language	-.234	(.920)	.234	(1.021)	7.68	.007
Organization	1.773	(.621)	1.879	(.614)	<1	ns
Ideas	2.053	(.534)	2.114	(.560)	<1	ns
Mechanics	2.248	(.562)	2.540	(.462)	10.61	.002
N		66			66	
					ANCOVA's (d.f.=1,109)	
					F	p<
POSTTESTS						
Organization	2.136	(.742)	1.894	(.682)	9.37	.003
Ideas	2.000	(.702)	1.932	(.679)	1.78	ns
Mechanics	2.261	(.495)	2.343	(.468)	<1	ns
N		66			66	
					Nested (Class-Level) Analyses (d.f.=1,19)	
					F	p<
ADJUSTED POSTTESTS						
Organization	2.188	(.681)	1.842	(.644)	6.29	.021
Ideas	2.038	(.616)	1.894	(.654)	<1	ns
Mechanics	2.310	(.436)	2.294	(.415)	<1	ns
N		66			66	