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ABSTRACT

Two studies evaluated a comprehensive cooperative learning approach to elementary reading and writing instruction, called Cooperative Integrated Reading and Composition (CIRC). The subjects in the first study, 461 third- and fourth-grade students in a suburban Maryland school district, were divided into experimental and control groups, with the experimental CIRC groups working in heterogeneous learning teams for all reading, language arts and writing activities. In reading, CIRC students worked with partners during follow-up times on partner reading, decoding, story structure, prediction, and story summary activities related to the basal stories. In writing and language arts, CIRC students used a process approach to writing and peer conferences during planning, revising and editing stages of the process. Subjects in the second study, 450 third- and fourth-grade students were chosen from a wider range of ethnic and socio-economic backgrounds than those in the first, although the second study was an extension and replication of the first. The results of both studies show significant effects in favor of the CIRC students on standardized test measures of reading comprehension, reading vocabulary, language mechanics, language expression and spelling. Also noted were effects favoring CIRC students on writing sample and oral reading measures. (Six tables of data are included, and 51 references are attached.) (NH)

Center for Research On Elementary & Middle Schools

Report No. 10

March, 1987

COOPERATIVE INTEGRATED READING AND COMPOSITION: TWO FIELD EXPERIMENTS

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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.

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This program works from a strong existing research base to develop, evaluate, and disseminate effective elementary school and classroom practices; synthesizes current knowledge; and analyzes survey and descriptive data to expand the knowledge base in effective elementary education.

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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, completes a series of three reports (see CREMS Reports Nos. 2 and 5) on experimental studies of the CIRC reading/writing program.

Abstract

This paper reports the results of two studies which 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, students worked with partners during follow-up times on partner reading, decoding, story structure, prediction, and story summary activities related to the basal stories. Students also received direct instruction on comprehension and metacomprehension activities, followed by team practice. In writing and language arts, students used a process approach to writing, and used peer conferences during planning, revising, and editing stages of the process. Students also received direct instruction followed by team practice on language mechanics and language expression activities which were integrated with the students' writing activities. The results of the studies show significant effects in favor of the CIRC students on standardized test measures of reading comprehension, reading vocabulary, language mechanics, language expression, and spelling. There were also effects favoring CIRC students on writing sample and oral reading measures.

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Cooperative Integrated Reading and Composition: Two Field Experiments

Over the past fifteen years, there has developed a substantial body of research on cooperative learning methods, in which students work in small, heterogeneous learning groups. More than fifty field experiments of four to thirty weeks' duration have established that when students work in four-member groups and are rewarded based on the learning of all group members, they achieve consistently more than do students who are in traditionally taught classes (Slavin 1983a, b). These studies have involved such subjects as mathematics, language arts, science, and social studies at grade levels from three to college.

However, conspicuously lacking in research on cooperative learning have been studies of two of the most important subjects in the elementary school curriculum: Reading and writing. This report describes the rationale, development, and evaluation of Cooperative Integrated Reading and Composition (CIRC), a comprehensive program for teaching reading, writing, and language arts in grades three and four.

Research and Development Plan. The overall plan of the research was to develop a complex cooperative learning approach to instruction in reading and writing, to study its overall effects, and then to study components of the model to determine the unique contribution of each. In contrast to most previous research on cooperative

learning, which has typically addressed instructional methods but not curriculum, the development of CIRC focused simultaneously on curriculum and on instructional method in an attempt to use cooperative learning as a vehicle for introducing state-of-the-art curricular practices derived primarily from basic research into the practical teaching of reading and writing.

The development of the CIRC model proceeded from an analysis of the problems of traditional reading and writing/language arts instruction. The following issues were addressed in the development process.

Follow-up. An almost universal feature of elementary reading instruction is the use of reading groups composed of students of similar performance levels (see Hiebert, 1983). The major rationale for the use of homogeneous ability groups in reading is that students need to have materials appropriate to their levels of skill. However, use of reading groups creates a problem; when the teacher is working with one reading group, the other students in the class must be occupied with activities they can complete with minimal teacher direction. Research on these "follow-up" activities, or unsupervised seatwork, indicates that they are often of poor quality, are rarely taken seriously by teachers or students, and are poorly integrated with other reading activities (e.g., Beck, McKeown, McCaslin, & Burkes, 1979; Osborn, 1984), and that student time on-task during follow-up periods is typically low (e.g., Anderson, Brubaker, Alleman-Brooks, & Duffy, 1985). But in a class

with three reading groups, as much as two-thirds of the reading period is spent on follow-up activities.

One major focus of the CIRC program activities related to basal stories is on making more effective use of follow-up time by having students work within cooperative teams on prescribed activities coordinated with reading group instruction and the basal story relating to objectives in such areas as reading comprehension, vocabulary, decoding, and spelling. Students are motivated to work with one another on these activities by the use of a cooperative reward structure in which they may earn certificates or other recognition based on the learning of all team members.

Oral Reading. Reading out loud is a standard part of most reading programs. Research on oral reading indicates that it has positive effects on students' decoding and comprehension skills (Dahl, 1979; Samuels, 1979), probably because it increases the students' ability to decode more automatically and therefore focus more attention on comprehension (LeBerge & Samuels, 1974; Perfetti, 1985). However, in traditionally structured classrooms students get to do very little oral reading. For example, Thurlow, Groden, Ysseldyke, & Algozzine (1984) found that on average, second graders read out loud only 90 seconds per day. Further, most oral reading takes place in reading groups, where one student reads while others wait, largely wasting the time of the reading group members other than the reader. One objective of the CIRC program was to greatly increase students' opportunities to read aloud and receive feedback

on their reading by having students read to teammates and training them how to respond to one another's reading.

Reading Comprehension Skills. Several descriptive studies of elementary reading instruction have noted an overemphasis on literal comprehension instead of interpretive and inferential comprehension (e.g., Guszak, 1967; Hansen, 1981) and a lack of explicit instruction in reading comprehension skills (Durkin, 1978-79, 1981). Studies of good and poor readers have consistently found that poor readers lack comprehension strategies and metacognitive control of their reading, and that these strategic deficits play a large part in their comprehension problems (e.g., Baker & Brown, 1984; Brown & Palinscar, 1982; Myers & Paris, 1978; Pace, 1981; Ryan, 1982).

Several experimental studies have demonstrated that explicit instruction in reading comprehension strategies and metacognitive monitoring processes can increase students' comprehension skills, at least those skills specifically taught in the interventions (Brown & Palinscar, 1982; Day, 1980; Hansen, 1981; Palinscar & Brown, 1984; Paris, Cross, & Lipson, 1984; Raphael, 1980; Stevens, in press). For example, Palinscar & Brown (1984) found that comprehension could be improved by teaching students summarizing, questioning, clarifying, and predicting skills. However, long-term applications of strategy training have not generally been found to increase reading comprehension on more broadly based standardized measures (e.g., Paris, Cross, & Lipson, 1984; Duffy, Roeler, Meloth, Vaurus, Book, Putnam, & Wesselman, 1986).

A major objective of the CIRC program was to use the cooperative teams to help students learn broadly applicable reading comprehension skills. Several program components were directed toward this end. During follow-up times, students worked in pairs to identify critical features of each narrative story relating to the story grammar: characters, setting, problems, attempted solutions, final solution (Stein & Glenn, 1979). Instruction in story structure has been found to increase reading comprehension of low-achieving students (e.g., Fitzgerald & Spiegel, 1983; Short & Ryan, 1982). Students in CIRC also make and explain predictions about how problems will be resolved and summarize main elements of stories to one another; both of these activities increase reading comprehension (e.g., Palinscar & Brown, 1984; Weinstein, 1982). One day each week, students in CIRC receive direct instruction in such comprehension-fostering strategies and metacognitive strategies using specially developed materials separate from basal-related instruction.

Writing and Language Arts. Research on elementary writing/language arts instruction has indicated that time allocated to these subjects focuses primarily on teaching of isolated language mechanics skills, with little time allocated to actual writing (e.g., Bridge & Hiebert, 1985; Graves, 1978). However, two parallel but related trends have created the potential for a substantial change in elementary writing and language arts instruction. First, basic research is developing a clearer understanding of the cognitive processes involved in writing (e.g., Bereiter & Scardamalia,

1982; Flower & Hayes, 1980; McCutchen & Perfetti, 1983; Scardamalia & Bereiter, 1986). Secondly, there has been a rapid expansion in use of writing process models, in which students are taught to use a cycle of planning, drafting, revising, editing, and publishing compositions (Gray & Myers, 1978; Calkins, 1983; Graves, 1983). Recently, the cognitive research tradition and the writing process tradition have been merged in a study in which instruction in text structures was embedded within a process writing model and found to enhance the quality of fifth and sixth graders' writing (Raphael, Englert, & Kirschner, 1986), but with this exception there has been little carefully controlled research on applications of writing process models to elementary writing/language arts instruction.

A major objective of the CIRC program was to design, implement, and evaluate a writing process approach to writing/language arts which would make extensive use of peers. Use of peer response groups is a typical component of most writing process models, but peer involvement is rarely the central activity. In the CIRC program, students planned, revised, and edited their compositions in close collaboration with teammates. Language mechanics instruction was completely integrated with and subordinated to writing, and writing was integrated with reading comprehension instruction both by incorporating process writing activities in the reading program and by incorporating newly learned reading comprehension skills in writing instruction.

The present research was intended to develop and evaluate a comprehensive cooperative learning model for the teaching of reading and writing in the upper elementary school grades. The overall plan of this research was first 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, described above. After development and pilot testing, the full model was to be evaluated in field experiments in comparison to untreated control groups. If the full program were effective, component analyses would 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). 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. Particularly in research on reading comprehension, where many researchers have questioned whether treatment effects on standardized reading comprehension scales are even possible (e.g., Paris, Cross & Lipson, 1984; Johnston, 1984), the need to first establish treatment effects for a complex program and only then conduct component analyses seemed especially great. For example, one of the few methodologically adequate, long-term studies which found positive effects on standardized reading measures used such a

complex, comprehensive approach (Anderson, Evertson and Brophy, 1979).

Program Overview

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

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

Teams. Students were assigned to pairs (or triads) within their reading groups, and then pairs were 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 received points based on their individual performances on all quizzes, compositions, and book reports, and these points were contributed to form a team score. Teams that met a minimum average criterion of 90% on all activities in a given week were designated "superteams" and received attractive certificates;

those which met an average criterion of 80-89% were designated "greatteams" and received less elaborate certificates. As noted earlier, research on the use of heterogeneous teams which were rewarded on the basis of individual members' performance has established the instructional effectiveness of this approach (Slavin, 1983a, b).

Basal-Related Activities. Students used their regular basal readers. Basal stories were introduced and discussed in teacher-led reading groups that met for approximately 20 minutes each day. During these groups, teachers set a purpose for reading, introduced new vocabulary, reviewed old vocabulary, discussed the story after students had read it, and so on. Presentation methods for each segment of the lesson were structured. For example, teachers were taught to use a vocabulary presentation procedure that required a demonstration of understanding of word meaning by each individual, a review of methods of word attack, repetitive oral reading of vocabulary to achieve automaticity, and use of the meanings of the vocabulary words to help introduce the content of the story. Story discussions were structured to emphasize such skills as making and supporting predictions about the story and understanding major structural components of the story (e.g. problem and solution in a narrative).

After stories were introduced, students were given a series of follow-up activities to do in their teams when they were not working with the teacher in a reading group. These seatwork activities were

directly related to the teacher-directed instruction of the reading group and to the basal stories in an attempt to make them more engaging and useful (Osborn, 1984). The sequence of activities was as follows:

a. Partner Reading. Students read the story silently first, and then orally with their partners. During oral reading they took turns reading aloud, alternating readers after each paragraph. As their partner read, the listener followed along and corrected any errors the reader made. This repeated reading of the story gave the students practice decoding the words in context, which has been found to contribute to decoding ability (Dahl, 1979; Samuels, 1979). Partner reading also gave students a great deal of oral reading practice, and enabled the teacher to assess student performance by circulating and listening, without having students read aloud in reading groups and waste the time of the other students in the group.

b. Story Structure and Story-Related Writing. Students were given questions related to each narrative story emphasizing the story grammar. Halfway through the story, they were instructed to stop reading and to identify and describe the characters, the setting, and the problem in the story, and to predict how the problem might be resolved. Understanding the structure of stories and making predictions based upon information presented are useful reading comprehension activities for students (Fitzgerald & Spiegel, 1983; Short & Ryan, 1982; Palincsar & Brown, 1984). At the end of

the story students responded to the story as a whole by answering questions about what happened in the resolution of the story, and by writing a few paragraphs on a topic related to the story using a truncated form of the draft-revise-edit sequence used in the writing/language arts component of the program, described below. For example, students might have been asked to write a different ending to the story based upon their previous prediction. This activity gave students practice elaborating on what they had read and helped them relate what they had read to their prior knowledge (Wittrock, 1981).

c. Words Out Loud. Students were given a list of new or difficult words used in the story which they had to be able to read correctly in any order without hesitating or stumbling. Students practiced these word lists with their partners or other teammates until they could read them smoothly and accurately. This practice helped students achieve automaticity in decoding these new words so that decoding would not interfere with students' comprehension of the story (LaBerge & Samuels, 1974; Perfetti, 1985).

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

e. Story Retell. After reading the story and discussing it in their reading groups, students summarized the main points of the story to their partners. When the students summarized the main points, they put the events in their own words, briefly restating them to their partners. Summarizing and paraphrasing content in one's own words has been found to improve the comprehension of what has been read (Doctorow, Wittrock & Marks, 1978; Weinstein, 1982).

f. Spelling. Students pretested one another on a list of spelling words each week, and then worked over the course of the week to help one another master the list. Students used a "disappearing list" strategy in which they made new lists of missed words after each peer assessment until the list disappeared. Then they returned to the full list, repeating the process as many times as necessary to master all of the spelling words.

Partner Checking. After students completed each of the activities listed above, their partners initialled a student assignment form indicating that they had completed and/or achieved criterion on that task. Students were given daily expectations as to the number of activities to be completed, but they could go at their own rate and complete the activities earlier if they wished, creating additional time for independent reading (see below).

Tests. At the end of three class periods, students were given a comprehension test on the story, were asked to write meaningful sentences for each vocabulary word, and were asked to read the word list aloud to the teacher. Students were not permitted to help one

another on these tests. The test scores and evaluations of the story-related writing were major components of students' weekly team scores and individual grades.

Direct Instruction in Reading Comprehension. One day each week, students received direct instruction on specific reading comprehension skills, such as identifying main ideas, drawing conclusions, and comparing and contrasting ideas. The instruction provided students with comprehension fostering strategies and metacognitive strategies like those used in previous basic and applied research in reading comprehension (Brown & Palincsar, 1982; Day, 1980; Hansen, 1981; Palincsar & Brown, 1984; Paris, Cross & Lipson, 1984; Raphael, 1980; Stevens, in press). A step-by-step curriculum was designed for this purpose. After each lesson, students worked on reading comprehension worksheets and/or games with other team members to practice the particular skill. First teammates would work cooperatively to gain consensus on one set of items, then they would practice independently, compare answers, and discuss discrepancies on a second set of items.

Integrated Language Arts and Writing. During language arts periods, the teachers used a specific language arts/writing curriculum developed for the project. The curriculum involved a series of teacher-directed lessons which began with instruction on writing complete sentences and moved step-by-step to instruction on writing narratives, descriptions, and other forms of writing. Language mechanics skills were integrated with the writing activities and

presented as an aid to improve writing rather than as a separate skill. For example, when students studied modifiers, they then used them in descriptive paragraphs. Similarly, students studied using quotation marks in conjunction with activities on writing dialogue. All language arts and writing activities involved cooperative practice and feedback within the learning teams.

Writing instruction used a process approach, where students worked with teammates to edit and revise their writing. Teammates edited one another's work using "peer editing forms" that emphasized both the content and the grammatical correctness of the composition. Then students revised their compositions on the basis of their peers' feedback. The peer editing forms began at a simple level but became increasingly complex as students covered more of the curriculum.

Independent Reading. Every evening, students were asked to read a trade book of their choice for at least twenty minutes. Parents initialled forms indicating that students had read for the required time, and students contributed points to their teams if they submitted a completed form each week. Students also completed at least one book report every two weeks, for which they received team points. Independent reading and book reports replaced all other homework in reading and language arts. If students completed their basal-related activities or other activities early, they could also read their independent reading books in class.

STUDY 1

Study 1: Method

Subjects and Design

The subjects in Study 1 (Madden, Stevens, & Slavin, 1986) were 461 third- and fourth-grade students in 21 classes in a suburban Maryland school district. The eleven experimental 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 in the study, and control teachers were promised training and materials at the conclusion of the intervention period. The treatments were implemented over a 12-week period during the spring semester, 1985. All of the teachers in each grade were allocated the same amount of time for reading and language arts/writing instruction. Third grades allocated two hours to reading and 45 minutes to language arts per day. Fourth grades allocated 90 minutes to reading and 60 minutes to language arts per day.

Treatments

Control. The control teachers continued using their traditional methods and curriculum materials. In reading this usually consisted of using basal series in three reading groups, with workbook & worksheet activities for follow-up time. In language arts and writing, fourth grade teachers typically used whole class instruc-

tion, and used published language arts programs for most of this instruction. However, in third grade, approximately half of the teachers used two or three ability groups for part of their language arts and writing instruction. Third grade teachers also used published language arts programs for most of their instruction. In spelling, both the control and experimental teachers used a published spelling program, selected from the district's adoption list. The spelling texts provided daily lessons and weekly tests. However, the control teachers used their traditional classroom process during spelling instruction, which differed from the experimental procedures described above.

Cooperative Integrated Reading and Composition (CIRC). The experimental teachers were trained in the CIRC program as described above. The training consisted of two three-hour sessions, and the teachers received a detailed teacher's manual. During the initial weeks of implementation, project staff observed the teachers and provided feedback concerning the teacher's implementation. The project staff continued monitoring the CIRC teachers' implementation at random intervals throughout the study.

Measures

Achievement Pretests. To adjust for students' initial performance levels, standardized test scores from district records were used as statistical adjustments 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 and fourth graders' were a year old. The pretest scores were transformed to z-scores separately for each grade so data from both grades could be combined. Writing samples administered at the start of the experiment were also used as statistical adjustments in all analyses of writing sample posttests.

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.

Writing Samples. At pre- and post-testing, 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 thihk 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. 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 assessments were made at three points during the rating period. Reliability estimates ranged from .83 to .97, with a mean reliability of .94.

Study 1: Results

Implementation

Observations of the experimental teachers revealed that all implemented each of the components of the CIRC program and maintained their level of implementation throughout the study.

Analyses

The standardized posttests were analyzed by adjusting for Total Reading and Total Language pretests. The adjusted scores were then used as dependent variables 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 writing sample scores were analyzed in a similar fashion, but included writing sample pretest scores along with Total Reading and Total Language in the adjustment. For all posttest analyses students were divided in thirds (high, middle, low) according to the sum of Total Reading and Total Language pretest scores. Individual-level analyses of variance with pretest, treatment, and pretest by treatment as independent varia-

bles were conducted to determine if there were ability-by-treatment interactions.

Pretests

As noted, 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

The class-level analyses found statistically significant differences favoring the experimental group on four of the five standardized tests, Reading Comprehension ($F=4.85$, $p<.04$), Reading Vocabulary ($F=4.62$, $p<.05$), Language Expression ($F=4.45$, $p<.05$) and Spelling ($F=11.29$, $p<.003$). These results are summarized in Table 1. The effect sizes (difference in adjusted means divided by the unadjusted individual-level control group standard deviation) of the significant results range from .175 to .240 standard deviations. The Table also presents estimated grade equivalent differences between experimental and control groups, after adjustments for pretests. These estimates were derived using norms from technical bulletins for the California Achievement Test. They show adjusted differences of 34% to 71% of a grade equivalent for the statisti-

cally significant differences on standardized measures. No significant interactions between pretest level and treatment were found on the standardized achievement 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 ($F=6.29$, $p<.02$), a difference of .51 standard deviations. No significant differences were found for Mechanics, paralleling the results for the standardized Language Mechanics scales, or for Ideas ratings. There were no significant ability-by-treatment interactions on the writing sample measures.

STUDY 2

The second study was an extension and replication of the first, using processes and curricula with revisions suggested by the feedback and experience from Study 1. The replication differed from the first study primarily in duration and demographics of the students. The duration of the study was 24 weeks, as opposed to 12 in the initial study. The second study also involved students from a wider range of ethnic and socio-economic backgrounds than those in the first study. Informal reading inventories were used as additional dependent measures in Study 2.

Study 2: Method

Subjects and Design

The subjects were 450 third- and fourth-grade students in 22 classes in a suburban Maryland school district. The nine experimental classes in four schools were matched on California Achievement Test scores for Total Reading and Total Language with thirteen control classes in five schools. There was also an attempt to control for ethnic and socio-economic background of the students by selecting matched classes from schools in the same or similar neighborhoods. Both experimental and control teachers volunteered to participate in the study, and control teachers were promised training and materials at the end of the intervention period. The treatments were implemented from October to March in the 1985-86

school year. The school district allocated two hours per day for reading in third grade, one hour per day in fourth grade, and one hour per day for language arts and writing in both third and fourth grade.

Treatments

Control. The control teachers continued using their traditional methods and curriculum. In reading, this consisted of two or three reading groups in a basal series, with workbooks and worksheets used as follow-up activities. In language arts and writing, the teachers used whole-class instruction and usually used published language arts programs.

Cooperative Integrated Reading and Composition (CIRC). The experimental teachers were trained in the CIRC program essentially as described above. Revisions were made, however, in the teacher-directed instruction in reading comprehension and language arts/writing. In reading comprehension, the teachers were provided with more specific instructions and examples for teaching the particular skills. This revision was made to improve the quality of the teachers' initial instruction. All other processes and activities in reading comprehension remained the same as described in Study 1.

The language arts/writing component of CIRC was revised to increase the amount of writing done by the students and the amount of feedback they received on their writing from the teacher and their peers. Three times a week, students spent their one-hour

language arts time in a "writer's workshop" (Calkins, 1983). At the beginning of the workshop, teachers presented a 10-15 minute lesson on topics related to the writing process (e.g., conducting a peer revision conference), style (e.g., eliminating run-on sentences) or language mechanics (e.g., using quotation marks). Students spent the majority of the writer's workshop planning, drafting, reviewing, revising, editing, and "publishing" compositions about self-selected topics. Both formal and informal conferences with the teacher and peers were used during the workshop to provide feedback to the writer. At the end of the workshop, students spent about ten minutes sharing and discussing their writing with the entire class. Language arts and writing instruction on the remaining two days involved teacher-directed lessons and team practice on specific aspects of writing (e.g., writing a good description) and language mechanics skills (e.g., noun-verb agreement).

The experimental teachers were trained in CIRC during two three-hour sessions. They also received a detailed teacher's manual for the program. Teachers were observed by project staff during the initial stages of implementation, and the staff provided feedback and guidance to the teachers in helping them resolve any problems. The project staff continued monitoring the teachers' implementation at random intervals throughout the study.

Measures

Achievement Pretests. Standardized test scores from district records were used as pretest adjustments in all analyses. The

scores were Total Reading and Total Language scale scores from the California Achievement Test. As in the first study, these tests were administered by the district during the fall of third grade, making the fourth graders' pretests a year old. The pretests were transformed to z-scores for each grade so the data from both grades could be combined. In addition, writing samples were administered as pretests, and used along with Total Reading and Total Language as adjustments in the analyses of the writing sample posttests.

Standardized Posttests. At the end of the experiment the students were administered the Reading Comprehension, Reading Vocabulary, Language Expression and Language Mechanics subtests of the California Achievement Test, Form D. Third graders were given Level 14 and fourth graders were given Level 15. As in the first study, the raw scores for each subtest were transformed to z-scores by grade, to enable combining scores across grades.

Writing Samples. Students were asked to complete a writing sample during pre- and posttesting, similar to the procedure used in the first study. The pretest and posttest 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 thihk 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:
> PRETEND that you have a friend in Florida who is your age. Your friend has never seen snow! Write a letter to your friend in Florida. See if you can give your friend a really clear

idea of what snow is like so that he or she can almost see it and feel it. Tell your friend about some of the fun things you have done in the snow this winter.

The writing samples were again scored using an analytic approach as described in the first study. Each sample was scored 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.

As in the first study, a subset of the project classes were scored, with each sample rated by two trained raters. After rating the sample individually, the raters conferred and arrived at a consensus score which was used in the final analyses. Reliability checks were conducted at three points during the rating period. Reliability estimates of the individual scales ranged from from .80 to .94, with a mean reliability of .87.

Informal Reading Inventories. At the end of the study a sample of the students in the experimental and control classes were administered the word lists and oral reading passages of the Durrell Analysis of Reading Difficulty (Durrell & Catterson, 1980). The word lists were used to measure students' word recognition and word analysis skills. The students were also asked to read paragraphs orally and raters recorded the time required, miscues, and comprehension scores for the paragraphs. Both the word lists and oral paragraphs were administered as described in the manual of directions which accompanies the Durrell inventory. On the word lists,

the interrater reliability (percent agreement) for the three raters ranged from 93.3% to 97.8%, with a mean of 95.2%. The interrater reliability on the oral paragraphs ranged from 95% to 100% for the miscue analysis, and from 90% to 100% on the comprehension measure.

Students were selected for this subsample by first matching individual experimental and control classrooms on Total Reading pretest scores. Then students in the experimental classrooms were matched individually with students in the control classroom. From this list of matched pairs, six pairs of students were randomly selected, two pairs from the top third, two pairs from the middle, and two pairs from the bottom third of the class. This random selection of matched pairs provided a reasonable representation of all levels of students in each classroom.

Study 2: Results

Implementation

As in Study 1, observations of the experimental teachers revealed that all were able to implement all of the components of the CIRC program. They also maintained their level of implementation throughout the study.

Analyses

The standardized posttests and the informal reading inventory measures were analyzed by adjusting for Total Reading and Total

Language pretests. The adjusted scores were then used as dependent variables in random effects, nested analyses of variance. As in the first study, the analyses nested classes within treatment, and used degrees of freedom related to the number of classes, thereby providing a measure of class-level effects. Writing sample posttest measures were similarly analyzed, with the writing sample pretest measures included in the adjustment. As in the first study, students were divided in thirds by initial achievement and data were analyzed to determine if there was an interaction between students' ability and the treatment.

Pretests

As described previously, experimental and control classes were matched on California Achievement Test scores on Total Reading. Analyses of the pretests found no differences between the treatment groups on either Total Reading or Total Language. Similarly, comparisons of the scores on the writing sample premeasures indicated no initial differences between experimental and control groups. The subpopulation used for the informal reading inventory posttest measures also had no significant pretest differences between the experimental and control group students.

Standardized Posttests

The class-level analyses found significant differences favoring the experimental group on the subtests for Reading Comprehension ($F=12.86$, $p<.002$), Language Expression ($F=4.76$, $p<.042$), and

Language Mechanics (F=7.57, p<.012), but not Reading Vocabulary (F=1.09, ns). These results are summarized in Table 3. The effect sizes for the significant differences range from .29 to .35 standard deviations, equal to grade equivalent differences from .64 to .66. No significant ability-by-treatment interactions were found.

Tables 3 and 4 Here

Writing Samples

The class-level analyses on the writing samples indicated a significant effect on Ideas (F=4.28, p=.05) in favor of the experimental group. The two other writing measures indicated no significant differences. These results are presented in Table 4. The effect size on the Ideas measure was .31 standard deviations. There were no significant ability-by-treatment interactions on the writing sample measures.

Informal Reading Inventory

The results of the ANCOVA on the oral reading measures indicate significant effects on word recognition (F=12,73, p<.003), word analysis (F=10.54, p<.006), grade placement (F=5.59, p<.033), time on a common paragraph (F=7.05, p<.019) and number of errors on a common paragraph (F=7.26, p<.017). All of these effects favor the experimental students. The results are summarized in Table 5. The

effect sizes on these oral reading measures range from .44 to .64 standard deviations. Again, no ability-by-treatment interactions were found on the oral reading measures.

Table 5 Here

Discussion

The results of these two field experiments support the effectiveness of the CIRC program in producing significantly better reading and language achievement of third- and fourth-grade students. The consistency, breadth and magnitude of these effects underscore the importance of the differences in favor of CIRC classrooms. In reading, the standardized achievement results are further supported by the measures of students' oral reading skills, as indicated by the informal reading inventory results. Taken as a whole, these results suggest that the CIRC students performed better on two major reading skills, decoding and comprehension. The second study did not replicate the significant effects on vocabulary found in the first study, but means in both studies favor CIRC on this variable (ES = .175 and .121 standard deviations, respectively).

The results in language arts and writing were somewhat less consistent, but were important nonetheless. In both studies students in CIRC showed substantial gains in standardized language

expression measures. The results in language mechanics are less consistent, but the second study found strong effects on this variable in favor of the CIRC classrooms. This result may be due to an improved integration of the language mechanics goals into the writing process during the longer intervention of the second study. Significant differences on ratings of writing samples were found for organization in Study 1 and ideas in Study 2, but in both studies trends on all writing sample measures clearly favored the CIRC students. Finally, students' achievement in spelling produced very substantial effects favoring CIRC in the first study. The standardized spelling test was not used as a dependent measure in the second study because of time constraints.

The significant effects on the informal reading inventories provide strong support for the partner reading and partner word-practice activities used in CIRC. In particular, the partner reading provides students with a great deal of practice reading orally, and this practice seems to be evidenced by improved fluency in reading for CIRC students, as measured by the grade placement, time, and error measures on the Durrell inventory. These results are not surprising given the finding that students spend very little time reading orally from basal texts (Thurlow, Groden, Ysseldyke and Algozzine 1984). Implementation of the partner reading component of CIRC results in much more practice on oral reading, and the practice seems to have resulted in greater automaticity in decoding and greater reading fluency.

The results of both studies indicate that the treatment was similarly effective for students of all ability levels, as shown by the lack of a significant ability-by-treatment interaction on any of the posttest measures.

Both studies had mainstreamed special education and remedial reading students in the samples. Data for these students were also analyzed separately and are discussed in detail in Madden, Stevens, Slavin, and Farnish (1986). Briefly, in Study 1 there were no significant treatment effects for this subsample, although the adjusted posttest scores were in the same direction as those of the full sample. In Study 2 the effects on reading vocabulary and comprehension were significant and substantial for mainstreamed special education students. The results for remedial reading students were similar, with significant effects on reading comprehension, language mechanics, and language expression. Furthermore, substantial effects on oral reading measures for the lowest third of each class confirm the effectiveness of the treatment for low ability readers in Study 2.

The difficulty in interpreting a study such as this which involves a complex program is that any of the many program elements could account for the observed effects. The effects on language expression on both standardized and writing sample measures may be attributed to the writing and language arts component, but it is impossible to determine if they are due to the teacher-directed lessons, peer conferences, or the writing process itself. It is

also possible that a portion of that result may be attributable to the large quantity of writing imbedded in the reading activities related to basal stories, especially the story related writing component. Similarly, the results on reading comprehension and reading vocabulary may be due to activities related to the basal stories (such as teaching story grammars, partner reading, mastery-oriented story comprehension practice), to direct instruction in comprehension strategies, or to the daily 20-minute independent reading component. Overlying all of these components is also the cooperative learning process and group rewards, which also may contribute to these results. Therefore, to better understand each of these components and their impact on students' achievement, component analysis research (see Slavin, 1984) is currently under way.

What the two field experiments reported here demonstrate is that when 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, they demonstrate that standardized measures of such skills as reading comprehension and reading vocabulary can be affected by treatments that simultaneously address student motivation, classroom management, curriculum, and metacognitive activities. The studies also show that teachers can effectively implement cooperative learning processes within a multifaceted reading and writing program in elementary schools. Future research will refine the methods and clarify the separate effects of

the program's component parts, but the results of these first studies establish that the overall approach has promise as a means of improving the outcomes of reading and writing instruction.

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Table 1
Means, Standard Deviations, and Analyses:
Standardized Achievement Measures, Study 1

	CIRC		CONTROL		ANOVA's (d.f.=1,459)	
PRETESTS	$\bar{x}$	(SD)	$\bar{x}$	(SD)	F	p<
Total Reading	-.056	(.941)	.053	(1.051)	1.38	ns
Total Language	-.143	(.943)	.136	(1.034)	9.13	.003
POSTTESTS						
Reading Comprehension	.045	(.971)	-.043	(1.025)		
Reading Vocabulary	.024	(.981)	-.024	(1.017)		
Language Expression	.057	(1.007)	-.054	(.991)		
Language Mechanics	-.006	(1.020)	.005	(.981)		
Spelling	.085	(1.029)	-.081	(.965)		
ADJUSTED POSTTESTS						
Reading Comprehension	.100	(.699)	-.095	(.668)		
Reading Vocabulary	.091	(.665)	-.087	(.643)		
Language Expression	.122	(.702)	-.116	(.720)		
Language Mechanics	.062	(.803)	-.059	(.733)		
Spelling	.141	(.788)	-.135	(.749)		
N	225		236			

CLASS-LEVEL ANALYSES (d.f.=1,19)

POSTTESTS	F	p<	Effect Size
Reading Comprehension	4.85	.040	.190
Reading Vocabulary	4.62	.045	.175
Language Expression	4.45	.048	.240
Language Mechanics	1.44	ns	.123
Spelling	11.29	.003	.286

ADJUSTED POSTTESTS IN GRADE EQUIVALENTS

	CIRC	CONTROL	Difference
Reading Comprehension	6.00	5.64	+.36
Reading Vocabulary	5.77	5.47	+.30
Language Expression	5.96	5.44	+.52
Language Mechanics	6.25	5.99	+.26
Spelling	6.25	5.53	+.72

Table 2
Means, Standard Deviations, and Analyses:
Writing Samples, Study 1

	CIRC		CONTROL		ANOVA's (d.f.=1,156)	
PRETESTS	$\bar{x}$	(SD)	$\bar{x}$	(SD)	F	p<
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
POSTTESTS						
Organization	2.136	(.742)	1.894	(.682)		
Ideas	2.000	(.702)	1.932	(.679)		
Mechanics	2.261	(.495)	2.343	(.468)		
ADJUSTED POSTTESTS						
Organization	2.188	(.681)	1.842	(.644)		
Ideas	2.038	(.616)	1.894	(.654)		
Mechanics	2.310	(.436)	2.294	(.415)		
N	74		84			

CLASS-LEVEL ANALYSES (d.f.=1,19)

POSTTESTS	F	p<	Effect Size
Organization	6.29	.021	+.507
Ideas	<1	ns	+.212
Mechanics	<1	ns	+.034

Table 3
Means, Standard Deviations, and Analyses:
Standardized Achievement Measures, Study 2

	CIRC		CONTROL		ANOVA's (d.f.=1,445)	
PRETESTS	$\bar{x}$	(SD)	$\bar{x}$	(SD)	F	p<
Total Reading	-.079	(1.082)	.050	(.940)	1.89	ns
Total Language	-.091	(1.070)	.062	(.948)	2.89	ns
POSTTESTS						
Reading Comprehension	.170	(.999)	-.111	(.986)		
Reading Vocabulary	.019	(1.015)	-.014	(.990)		
Language Expression	.150	(1.005)	-.097	(.984)		
Language Mechanics	.135	(1.060)	-.079	(.961)		
ADJUSTED POSTTESTS						
Reading Comprehension	.229	(.704)	-.115	(.741)		
Reading Vocabulary	.096	(.766)	-.024	(.720)		
Language Expression	.199	(.706)	-.088	(.733)		
Language Mechanics	.181	(.700)	-.109	(.775)		
N	173		274			

CLASS-LEVEL ANALYSES (d.f.=1,20)

POSTTESTS	F	p<	Effect Size
Reading Comprehension	12.86	.002	.349
Reading Vocabulary	1.09	ns	.121
Language Expression	4.76	.042	.292
Language Mechanics	7.57	.012	.302

ADJUSTED POSTTESTS IN GRADE EQUIVALENTS

	CIRC	CONTROL	Difference
Reading Comprehension	5.92	5.26	+.64
Reading Vocabulary	5.43	5.23	+.20
Language Expression	5.42	4.78	+.64
Language Mechanics	6.09	5.43	+.66

Table 4
Means, Standard Deviations, and Analyses:
Writing Samples, Study 2

	CIRC		CONTROL		ANOVA's (d.f.=1,170)	
PRETESTS	$\bar{x}$	(SD)	$\bar{x}$	(SD)	F	p<
Total Reading	-.006	(1.079)	.004	(.944)	<1	ns
Total Language	-.089	(1.081)	.059	(.938)	<1	ns
Organization	1.630	(.573)	1.485	(.515)	2.98	ns
Ideas	1.848	(.614)	1.796	(.612)	<1	ns
Mechanics	2.123	(.565)	2.103	(.540)	<1	ns
POSTTESTS						
Organization	2.065	(.562)	1.956	(.491)		
Ideas	1.877	(.401)	1.745	(.441)		
Mechanics	2.319	(.492)	2.265	(.401)		
ADJUSTED POSTTESTS						
Organization	1.786	(.471)	1.682	(.475)		
Ideas	1.678	(.375)	1.542	(.413)		
Mechanics	1.884	(.381)	1.822	(.367)		
N	69		103			

CLASS-LEVEL ANALYSES (d.f.=1,20)

POSTTESTS	F	p<	Effect Size
Organization	1.14	ns	+.212
Ideas	4.28	.052	+.308
Mechanics	< 1	ns	+.155

Table 5
Means, Standard Deviations, and Analyses:
Informal Reading Inventories, Study 2

	CIRC		CONTROL		ANOVA's (d.f.=1,88)	
PRETESTS	$\bar{x}$	(SD)	$\bar{x}$	(SD)	F	p<
Total Reading	.012	(.991)	-.016	(1.011)	<1	ns
Total Language	.036	(1.030)	-.025	(.962)	<1	ns
POSTTESTS						
Word Recognition	.291	(1.086)	-.273	(.883)		
Word Analysis	.210	(1.121)	-.203	(.870)		
Grade Placement	.266	(1.047)	-.248	(.950)		
Time*	-.352	(.961)	.292	(1.031)		
Error*	-.216	(1.014)	.211	(.975)		
N	45		45			

INDIVIDUAL LEVEL ANCOVA'S (d.f.=1,86)

POSTTESTS	F	p<	Effect Size
Word Recognition	12.73	.003	+.636
Word Analysis	10.54	.006	+.471
Grade Placement	5.59	.033	+.547
Time	7.05	.019	+.621
Error	7.26	.017	+.439

* Time and error scores are for oral reading of a common paragraph at the grade level of the students. Negative z-scores indicate that the students took less time or made fewer errors when reading.