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AUTHOR Klein, James D.; Cavalier, Jamie C.
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ABSTRACT

The purpose of this study was to investigate the effect of implementing cooperative learning and objectives with computer-based instruction (CBI). Subjects were 125 fifth and sixth grade students. Cooperative dyads and individuals worked through a CBI earth science program that contained either instructional objectives, advance organizers, or no orienting activities. Results indicated that students who received instructional objectives performed significantly better on intentional posttest items than students who received either advance organizers or no orienting activities. Results also revealed that dyads who received objectives exhibited significantly more on-task group behaviors, more helping behaviors, and fewer off-task behaviors than dyads in the other orienting activity conditions. Furthermore, learning strategy influenced time on task; individuals spent significantly more time on instruction and practice than cooperative dyads. Implications for CBI developers are explored. (Contains 52 references.) (Author/MES)

Using Cooperative Learning and Objectives with Computer-Based Instruction

By:

James D. Klein & Jamie C. Cavalier

USING COOPERATIVE LEARNING AND OBJECTIVES WITH COMPUTER-BASED INSTRUCTION

James D. Klein
Arizona State University

Jamie C. Cavalier
Mesa Community College

Abstract

The purpose of this study was to investigate the effect of implementing cooperative learning and objectives with computer-based instruction (CBI). Cooperative dyads and individuals worked through a CBI earth science program that contained either instructional objectives, advance organizers, or no orienting activities. Results indicated that students who received instructional objectives performed significantly better on intentional posttest items than students who received either advance organizers or no orienting activities. Results also revealed that dyads who received objectives exhibited significantly more on-task group behaviors, more helping behaviors, and fewer off-task behaviors than dyads in the other orienting activity conditions. Furthermore, learning strategy influenced time on task; individuals spent significantly more time on instruction and practice than cooperative dyads. Implications for CBI developers are explored.

Introduction

Computer-based instruction (CBI) is becoming a more widely accepted instructional delivery medium in schools. However, access to computer resources is limited in most classrooms. Teachers who do have computers available usually have one or two in their classrooms or have access to computer labs with fewer than 15 workstations (Becker, 1991). Working with these restrictions, teachers have limited options. They may assign computer time to individual students on some type of rotation basis or assign groups of students to work at the computer. Grouping students may be a practical solution to equipment shortage. However, it is not clear how groups perform using computer programs traditionally designed for individual students.

While teachers frequently group students to work together on CBI, software developers have normally presumed that their programs would be used by individual students (Cosden, 1989). Recently, a search of 14 educational software catalogs revealed that only 40 out of 5,964 CBI programs were designed with the option of implementing the program with more than one student at a time (Cavalier, 1996).

Since teachers often group students together to use computers, it is important to determine the factors that influence learning and motivation in these settings. Several researchers have examined the effect of implementing cooperative learning with CBI. Some have found positive effects for achievement and attitude when small group strategies were used with CBI (Dalton, Hannafin, & Hooper, 1989; Hooper, Temiyakarn, & Williams, 1993; Johnson, Johnson, & Stanne, 1985; Mevarech, Silber, & Fine, 1991; Trowbridge & Durnin, 1984). Others have reported that individual and cooperative methods were equally effective when used with CBI (Carrier & Sales, 1987; Cavalier, 1996; Crooks, Klein, Jones, & Dwyer, 1997; Doran, 1994; Klein & Doran, 1997; Orr & Davidson, 1993).

According to Klein and Pridemore (1994), the mixed results for studies that have examined cooperative learning with media may be due to the orienting activities employed within mediated lessons. An orienting activity is a mediator through which new information is presented (Hannafin & Hughes, 1986). Orienting stimuli evoke inspection behaviors in learners, which help to influence what is learned from textual material (Rothkopf, 1970). An example of an orienting activity is when learners are provided with the objectives of a lesson. According to Gagne (1985), objectives help to activate a mental set that focuses student attention and directs selective perception of specific lesson content.

Reviews of research have generally supported the prescription of providing objectives to learners. However, inconsistencies in the results of these studies have suggested that objectives as orienting activities may not be effective in every learning setting (Duchastel & Merrill, 1973; Hamilton, 1985; Hannafin & Hughes, 1986; Melton, 1978). Researchers have indicated that objectives increase the attainment of factual information, but do little to help students process higher level skills (Clark, 1984, Hannafin, 1985; Ho, Savenye, & Haas, 1986; Mayer, 1984). Others have reported that objectives enhance learning of intentional or test-relevant content, but provide little assistance for learning incidental material (Duchastel, 1972, 1977; Duchastel & Brown, 1974, Kaplan & Simmons, 1974; Morse & Tillman, 1972; Rothkopf & Kaplan, 1972, 1974).

In addition to objectives, another orienting activity is supplying learners with advance organizers. Ausubel (1968) defined an advance organizer as "relevant and inclusive introductory materials . . . introduced in advance of learning . . . at a higher level of abstraction, generality, and inclusiveness" (p. 148). Advance organizers relate potentially meaningful information to be learned to existing structures that exist within a learner's memory; they

serve as a vehicle to assist learners to incorporate new information into existing schema (Ausubel, 1960, 1968). Advance organizers remind students of something they already know and assist in organizing information to be learned (Gagne & Driscoll, 1988). According to Mayer (1979), advance organizers provide the learner with a framework that allows for integrative relationships to be formed between new and existing knowledge; knowledge that is acquired goes beyond an isolated fact or concept and is integrated into a larger schema. Furthermore, an advance organizer promotes learning when new content is not well organized; as the structure of to be learned material decreases, the greater the advantage of using an advance organizer as an orienting activity (Mayer, 1977, 1979).

Researchers have found that advance organizers increase both retention and comprehension of instructional content (Ausubel, 1968; Mayer, 1984; Stone, 1983). But advance organizers have not facilitated performance in every learning setting. Some researchers have indicated that advance organizers provide students with more support of incidental information rather than recall of specific or intended learning (Ausubel, 1978; Hannafin, 1987; Mayer, 1979). Others have reported that subjects given advance organizers outperformed those who were not given this orienting activity on material that required broad assimilation and better understanding; both groups performed similarly on factual test items (Krahn & Blanchaer, 1986). Finally, the benefits of advanced organizers have been reduced when more powerful instructional elements such as practice were included in CBI lessons (Hannafin, 1987; Hannafin, Phillips, Rieber, & Garhart, 1987; Phillips, Hannafin, & Tripp, 1988).

The purpose of the current study was to investigate the effect of implementing cooperative versus individual learning and orienting activities during a CBI program. Cooperative dyads and individuals worked through a CBI earth science program that contained either instructional objectives, advance organizers, or no orienting activities. While a number of studies have been conducted to examine the separate effects of cooperative learning and orienting activities during CBI, no research has investigated the effects of both cooperative learning and orienting activities during CBI. A study by Klein and Pridemore (1994) indicated that orienting activities influenced student interactions and knowledge acquisition when students implemented cooperative learning with instructional television. The current study was conducted to determine if those results could be extended to computer-based instruction.

Method

Design and Subjects

A 2 X 3 factorial design was used for this study, with learning strategy (cooperative versus individual learning) and orienting activity (objectives, advance organizers, none) as the independent variables. The dependent variables were performance and attitude. Time on task and student interaction behaviors were also examined.

Subjects were 125 fifth and sixth graders enrolled at an elementary school located in a lower socioeconomic neighborhood in metropolitan Phoenix. The school was organized in pods where grade levels were combined to allow for group and individual learning in various subjects and special projects. The fifth and sixth grade students who were subjects in this study were members of the same pod. Each class of fifth and sixth graders was comprised of approximately 30 students. Subjects attended a weekly 45-minute class session in a computer lab of 28 networked Apple Macintosh LC computers. Prior to this study, subjects had been taught basic computer skills such as word processing and presentation graphics. Subjects were also experienced in using cooperative learning strategies. They regularly had participated in small group projects in science, math, and social science in the classroom. However, subjects usually worked individually at the computer during the weekly lab session.

Materials

An original computer-based instruction (CBI) program entitled Prospecting for Arizona's Treasures was developed for this study. The program was a Hypercard tutorial that presented information about the tools, equipment, people, and methods used in modern prospecting. The content was written at a fifth grade reading level. Six versions of the CBI were developed with all possible combinations of learning strategy and orienting activity used.

The tutorial contained the same content for all versions. The program consisted of a total of 140 screens. There were 20 introductory screens, 78 information screens, 34 practice screens with feedback, 5 practice/feedback score screens, and 3 exit screens at the end of each lesson. All subjects progressed through all screens sequentially while controlling the pace of the lesson. The tutorial consisted of an introductory section and three lessons.

The introductory section consisted of five parts: identification information solicited from subjects, motivational information, navigation information, cooperative or individual instructions, and the appropriate orienting activity. Subjects were prompted to enter an assigned identification number and their first name. These data were used by the program to address each student by name and assign tasks throughout the program. Motivational screens presented reasons for studying prospecting in Arizona. The content of these screens focused on the impact of the mining industry in Arizona. Information and practice on button operation, function, and navigation was also presented in the introduction. As subjects practiced navigation, they were informed that a posttest would be

administered at the conclusion of the CBI and extra credit points would be earned by those who attained a posttest score of 80% or more. These screens also instructed subjects in the cooperative groups to discuss all information and practice exercises, and assigned roles and responsibilities to each dyad member. The final screen in the introduction displayed the appropriate orienting activity for Lesson 1, Unit 1.

Lessons 1 and 2 consisted of two units each. Lesson 3 consisted of one unit. Each unit had an orienting activity, information, practice, and feedback. Two versions of the program contained instructional objectives, two versions contained advance organizers, and two versions contained no orienting activities.

Objectives were presented as verbal information outcomes that students were expected to possess after instruction (Gagne, 1985). Each unit included 3 - 5 objectives. Each objective was listed on a separate line preceded by a bullet to draw attention to them. Advance organizers were structured using the approach described by Ausubel (1968, p. 148) as "materials presented at a high level of abstraction, generality, and inclusiveness that can serve as anchoring ideas for the information to be learned. Each unit included an advance organizer. Each advance organizer was presented in paragraph format and included 55 – 65 words.

Information was presented in a story format for all three lessons. A narrator character acted as guide by introducing students to members of a modern prospecting team. Subjects were told that they would accompany the team on a search for gold, silver, and copper simulating a prospecting trip. Characters acted out the storyline, with the narrator character interrupting the story with comments, instructions, and assignment of tasks. The units of each lesson served as a scene change for the storyline and the narrator presented the appropriate orienting activity at the start of each unit. Lesson 1, Unit 1 is described below as an example of the structure of each lesson.

Unit 1 introduced three members of a modern prospecting team and the equipment that each takes on a preliminary search for metallic mineral deposits. The search strategy had been predetermined by various methods that are discussed by the prospectors as the story unfolded. At the end of the unit, the narrator presented a series of five, short-answer practice items. Practice items were directly aligned with the objectives for each unit and required subjects to provide information about the tools, equipment, people, and methods used in prospecting. The tutorial was programmed to allow for a variety of spellings and variations in subject responses.

The CBI was field tested prior to the study with a small group of fifth and sixth graders of average ability. Revisions were made as needed to ensure transparent program navigation and clarity for subjects. For example, navigation instructions were added at the beginning of each lesson rather than placing them in the overall introduction. Furthermore, several practice items were reworded to improve clarity.

The cooperative version of the CBI incorporated the elements of positive interdependence, face-to-face interaction, and individual accountability (Johnson & Johnson, 1989; Slavin, 1991). Positive interdependence was established by assigning tasks and responsibilities to dyad members, by cueing students to switch these roles, and by providing extra credit points when both members of a dyad achieved 80% or better on the posttest. Eighty percent was considered mastery level at the subjects' elementary school. Face-to-face interaction was promoted by instructing dyads to discuss key information and their responses to practice items. Individual accountability was established by having each member of dyad independently complete the posttest.

The individual version of Prospecting for Arizona's Treasures differed from the cooperative version only on those screens which provided directions and cues for the dyads to cooperate. Individuals were provided the same incentive to perform well on the posttest; those subjects who achieved 80% or more on the posttest received extra credit points.

In addition to the CBI lesson, a script of oral instructions to subjects was designed by the researchers. Oral instructions prior to each computer session were the same for all subjects. The script informed all subjects how to respond if they needed assistance with the program and how to enter their ID number and name. Instructions pertaining to the program differed for subjects in the cooperative and individual groups. The script for cooperative groups provided instructions on how to cooperate. These instructions informed subjects that they would be working with a partner at the computer, that the program was designed so that they could help each other perform well on the practice items, and that both had specific tasks that they were to perform. Oral instructions also prepared subjects for switching tasks at the beginning of each unit. For example, the oral instructions for Lesson 1, Unit 1 were as follows: "You will be working with a partner at the computer. This program was designed for you to help each other. Both of you will have jobs to do while you go through the program. You should talk about what is happening in the story and work together to get the answers to the practice questions. Lesson 1 has two units. At the beginning of the second unit, you will switch jobs. The program will tell you when to do this." These instructions were similar for each of the three computer sessions.

Procedures

There were six treatment groups in this study. The treatment groups were cooperative learning-objectives, cooperative learning-advance organizers, cooperative learning-no orienting activity, individual learning-objectives, individual learning-advance organizers, and individual learning-no orienting activity.

Prior to assigning subjects to treatment conditions, reading ability scores from the Iowa Test of Basic Skills (ITBS) were obtained. The mean score and standard deviations for each of the four intact classes were 45.37 (SD = 25.33), 47.56 (SD = 24.85), 49.26 (SD = 24.43), and 53.22 (SD = 24.64). In order to achieve a balance between treatments, the classes with the highest and lowest means were combined to make one group, while the two remaining classes were combined to make another group. Both of these groups were then randomly assigned to either the cooperative or individual condition. The mean score for the cooperative treatment group was 49.30 and was the mean score for the individual treatment group was 48.41.

Reading scores were also used to assign partners to subjects in the cooperative treatment. Using an overall median score of 45, subjects were identified as either high ability or low ability. One high and one low ability student was randomly assigned to each cooperative dyad. Teachers reviewed these pairings to verify that each dyad included a high and low ability learner. After subjects in the cooperative treatment were paired, each dyad was randomly assigned to one of the orienting activity conditions. Subjects in the individual treatment were also randomly assigned to an orienting activity.

The study consisted of three 45-minute computer sessions conducted on three consecutive days. Each group was given two 45-minute class periods to complete Lessons 1 and 2, and 30 minutes of the third class period to complete Lesson 3. The remainder of the third class period (15 minutes) was spent completing a student attitude survey.

When subjects arrived at the computer lab, they were instructed to sit at their assigned computer but not to type at the keyboard. When all subjects were seated, instructions were read to them. Subjects were told that they would be working at the computer to complete a lesson and were instructed to raise their hand if they had a question. Cooperative dyads were instructed to decide who would keyboard first and informed that the computer would prompt them to change roles at the beginning of each unit. Subjects were then instructed to launch the appropriate version of the CBI. Subjects in all treatments worked through each lesson at their own pace. While cooperative subjects worked through each lesson, a trained observer recorded instances of interaction behaviors. All cooperative dyads were observed during all three lessons. Upon conclusion of Lesson 3, all subjects individually completed an attitude survey in the computer lab. Upon returning to the classroom, teachers distributed a posttest and all students individually completed it.

Criterion Measures

The two criterion measures in this study were a posttest and an attitude survey. In addition, time-on-task and student interaction behaviors were measured.

A 30-item, short-answer, paper-and-pencil posttest was used to measure acquisition of the information presented throughout the CBI lesson. The posttest was divided into two sections; 15 items addressed intentional learning and 15 items addressed incidental learning. Intentional learning items were directly aligned to the outcomes of each lesson and were similar to the practice items found in the CBI program. Two examples of intentional items are "Name three members of a modern prospecting team" and "What tool would you use to break off a piece from an outcropping?" Incidental learning items tested information that was provided throughout the program, but not directly practiced or aligned with the outcomes of each lesson. Two examples of incidental items are "Name two reasons that a laptop computer is a good tool to take into the field" and "Why do minerals fall to the bottom of a stream?" Each section of the posttest was worth 20 points. Individual answers to an item were checked against a scoring key and points were assigned for each response. An item was worth one point unless it required a multiple response. One person scored all of the items on this test. The Kuder-Richardson internal-consistency reliability was .88 for the entire posttest.

A 10-item Likert-type survey was administered prior to the posttest to determine student attitudes. It measured a subjects preference for cooperative or individual learning, confidence level toward knowing what was to be learned at the beginning of each lesson through the orienting activity, perceived value of practice as test preparation, degree of difficulty in understanding the content, enjoyment of working on a computer, use of a storyline to convey content, and interest in prospecting as a topic. The Cronbach Alpha internal reliability of this attitude survey was .67.

Interaction behaviors for a sample of 34 cooperative dyads (14 received objectives, 11 received advance organizers, 9 received none) were observed and recorded by two trained observers. The classification of interaction behaviors was based on research by Webb (1982, 1987) and Klein and Pridemore (1994). These interaction classifications were divided into four sets of behaviors: helping, on-task group, on-task individual, and off-task behaviors. Helping behaviors included asking for help, giving help when asked, and unsolicited help. On-task group behaviors were taking turns and group discussion. On-task individual behaviors were assuming control and working alone. Off-task behavior included talking about something unrelated to the lesson and nonverbal actions such as reading or working on other assignments. Inter-rater reliability was conducted to ensure consistency of interaction observations. Reliability estimates were .92 for helping behaviors, .95 for on-task group behaviors, .91 for on-task individual behaviors, and .96 for off-task behaviors.

Each observer was centrally located among the computer stations. At two-minute intervals, the observers recorded the interaction behaviors of a dyad and then rotated to the next cooperative dyad. Observations continued throughout each of the three class periods while dyads worked at the computer. Each dyad was observed five times during the study. Interactions were documented on the interaction criteria scoring sheet for type and amount. As each behavior was observed, a tick was recorded on the score sheet.

Embedded in the CBI was a tracking routine that provided raw data on time spent on each screen as subjects progressed through the tutorial. Time spent on orienting activities screens, instructional screens, and practice and feedback screens was captured for tabulation. The time spent on each lesson and the overall time for the CBI was also collected.

Data Analysis

A separate 3 X 2 multivariate analysis of variance (MANOVA) was conducted on data for performance, attitude, and time on task. The dependent variables for the MANOVA on performance were scores on intentional and incidental posttest items. The MANOVA for attitude used each survey item as a dependent measure. The dependent measures for the MANOVA on time on task were time spent on orienting activities, time spent on instruction, time spent on practice, and total time in the program. A one-way MANOVA was conducted on interaction behaviors to determine the effect of orienting activities on the interactions of subjects in the cooperative treatments. Interaction behaviors were considered as a group-based measure, since a combined score was obtained for subjects in each cooperative dyad. Each MANOVA was followed by univariate analyses if a significant multivariate result was found. Scheffe multiple comparison tests were also conducted when a univariate test indicated a significant main effect for orienting activities. Alpha was set at .05 for all statistical tests.

Results

Performance

A 3 X 2 MANOVA conducted on posttest scores revealed a significant main effect for type of orienting activity, $F(4,218) = 3.11$, $p < .05$. MANOVA did not reveal an effect for learning strategy or an interaction between orienting activity and learning strategy. Follow-up univariate analyses indicated that type of orienting activity had a significant effect on intentional posttest scores, $F(2,110) = 6.35$, $p < .01$, ES = .74, but not on incidental scores. Scheffe multiple comparison tests revealed that subjects who received instructional objectives ($M = 12.30$) performed significantly better on the intentional portion of the posttest than those subjects who received advance organizers ($M = 10.16$) and those who received no orienting activities ($M = 9.39$).

Time on Task

A 3 X 2 MANOVA conducted on time data revealed a significant main effect for learning strategy, $F(4;76) = 6.22$, $p < .001$. MANOVA did not reveal a significant effect for orienting activity or an interaction between learning strategy and orienting activity. Follow-up univariate analysis showed that individuals spent significantly more time on instruction, $F(1,79) = 14.35$, $p < .001$, ES = .80, and practice, $F(1,79) = 20.36$, $p < .001$, ES = .92, than subjects working in cooperative dyads.

Attitudes

Mean scores for the attitude survey suggested that most subjects liked using the computer program ($M = 1.94$) and thought the story made it fun to learn ($M = 2.24$). Subjects indicated that the information was easy to understand ($M= 2.08$) and that the practice was helpful ($M= 1.82$). Subjects who worked cooperatively reported that they liked working with a partner ($M= 2.00$) while those who worked individually indicated that they liked working alone ($M = 2.36$). Furthermore, subjects in all orienting activity conditions felt that they knew what they were supposed to learn from the program ($M = 1.99$). A 3 X 2 MANOVA conducted on the attitude data did not reveal a significant main effect for orienting activity, learning strategy, or an interaction between these variables.

Interaction Behaviors

A one-way MANOVA conducted on interaction behaviors revealed a significant main effect for type of orienting activity, $F(2,13) = 5.92$, $p < .001$. Follow-up univariate analyses indicated that orienting activity had a significant effect on helping behaviors, $F(2,31) = 5.55$, $p < .01$, on-task group behaviors, $F(2,31) = 6.09$, $p < .01$, on-task individual behaviors, $F(2,31) = 4.58$, $p < .05$, and off-task behaviors, $F(2,31) = 8.83$, $p < .001$. Scheffe tests indicated that cooperative dyads who received objectives exhibited significantly more helping behaviors and more on-task group behaviors than those who did not receive orienting activities. Scheffe tests also revealed that dyads who did not get orienting activities exhibited significantly more on-task individual behaviors and more off-task behaviors than those who received either objectives or advance organizers.

Discussion

The purpose of this study was to investigate the effect of implementing cooperative learning and objectives with a CBI program. Cooperative dyads and individuals worked through a CBI earth science program that contained either instructional objectives, advance organizers, or no orienting activities. The study examined the effects of learning strategy and orienting activities on intentional and incidental posttest performance, time on task, student attitudes, and cooperative interaction behaviors.

Results indicated that students who received instructional objectives throughout the program performed significantly better on intentional posttest items than students who received either advance organizers or no orienting activities. Providing objectives at the beginning of each computer unit most likely directed student attention and selective perception of relevant content (Gagne, 1985). The objectives may have helped students focus on the learning task.

It is also likely that objectives enhanced performance on intentional scores because the objectives provided a clear link between expectancies for learning and incentive for learning. In this study, all versions of the CBI program informed students that (1) they would take a test at the end of the program, (2) it was important to learn all they could about prospecting, and (3) they would receive extra credit for achieving 80% or better on the test. This information was immediately followed with the appropriate orienting activity for Unit 1. Students who received the objectives may have seen a more direct relationship between incentives and expectancies than other students.

The results of this study support the work of other researchers who have reported that objectives enhance learning of intentional or test-relevant content (Duchastel, 1972, 1977; Duchastel & Brown, 1974, Kaplan & Simmons, 1974; Morse & Tillman, 1972; Rothkopf & Kaplan, 1972, 1974). However, the current study does not corroborate the findings of those who have suggested that advance organizers provide students with support of incidental information (Ausubel, 1978; Hannafin, 1987; Mayer, 1979).

Advance organizers did not influence incidental learning in the present study. This result was likely due to the CBI program used by students. It was designed following a systems approach and included most of the elements of effective instruction proposed by instructional design theorists (Dick & Carey, 1996; Gagne, 1985; Sullivan & Higgins, 1983). Mayer (1977, 1979) suggested that an advance organizer promotes learning when new content is not well organized. Furthermore, others have found that the benefits of advance organizers are reduced when more powerful instructional elements such as practice are included in mediated instruction (Bertou, Clasen, & Lambert, 1972; Hannafin, 1987; Hannafin, Phillips, Rieber, & Garhart, 1987; Klein & Pridemore, 1994; Phillips, Hannafin, & Tripp, 1988).

It is also possible that advance organizers did not influence learning in the current study because of the nature of the items used to test for intentional and incidental learning. All posttest items measured student acquisition of factual information presented in the CBI lesson. Other researchers have reported that advance organizers do not always increase the attainment of facts (Krahn & Blanchaer, 1986). In addition, Mayer (1979) theorized that advance organizers help learners acquire knowledge beyond an isolated fact or concept. Furthermore, the lack of effect for advance organizers in the present study may be due to the design of the organizers themselves. While the advance organizers were designed to include "relevant introductory materials at a high level of abstraction, generality, and inclusiveness" (Ausubel, 1968, p. 148), little attempt was made to relate information to be learned about prospecting for minerals to students' existing mental structures and schema.

In addition to performance, results of the current study revealed that orienting activities had a significant influence on the interaction behaviors of dyads. Dyads who received objectives exhibited significantly more on-task group behaviors and helping behaviors than those who did not receive orienting activities. In addition, dyads who received either objectives or advance organizers exhibited significantly fewer off-task behaviors than students who did not receive orienting activities. These results support Klein and Pridemore (1994) who indicated that providing objectives to cooperative groups may be an effective method for increasing student interactions.

It is possible that the objectives version of the program provided dyads with a clear goal to accomplish. Most successful cooperative learning methods include some type of group goal (Johnson & Johnson, 1989; Slavin, 1990). Dyads who received objectives probably had a better understanding than other dyads of the goals and expectations of the CBI lesson. According to Gagne (1985) informing the learner of objectives activates expectancies which "represent the specific motivation of learners to reach the goals of learning that have been set for them" (p. 78).

While orienting activities influenced cooperative behaviors in this study, the performance and attitudes of students in both the cooperative and individual treatments was about the same. Again, these results likely occurred because the CBI was designed following a systematic approach. Students may have found the presentation of the content engaging and the structure of the instruction straightforward enough to overcome any preference for a particular learning strategy. Other researchers have suggested that cooperative learning studies which include well-designed instructional materials do not consistently show differences in favor of cooperative strategies (Bossert, 1988-89; Klein & Doran, 1997; Snyder, 1993). It is also possible that performance and attitude were similar for

individuals and dyads because the lesson focused on the acquisition of verbal information instead of skills or problem solving.

While learning strategy did not influence performance or attitude, results revealed that individuals spent significantly more time on the CBI than dyads. This is somewhat surprising, in light of Slavin's (1990) review that indicated, "most studies that have measured time on task have found higher proportions of engaged time for cooperative learning students than for control students" (p. 47). However, the increased time for individuals may be explained through direct observation of students. Observers noted that individuals appeared less focused than dyads and were easily distracted. Individuals seemed to exhibit more off-task behavior and thus spent more time on the program. In contrast, cooperative dyads seemed to be more attentive to task. Dyads appeared to have little difficulty working cooperatively at the computer and demonstrated an efficiency of task. Thus, dyads spent less time than individuals on each screen. These findings suggest that cooperative dyads who have experience working in groups are likely to be more efficient with their learning than students working alone at the computer. However, the fact that dyads were formally observed and individuals were only informally observed, could account for dyads being more attentive to task than individuals.

The present study has some implications for practitioners who develop and implement CBI. Results strengthen the prescription of providing students with instructional objectives during CBI to increase learning of relevant information. Furthermore, findings support the use of objectives for increasing the interactions of students who work together during CBI lessons. Providing objectives to students may reinforce the structure and goals of a CBI lesson even when it is well-organized and includes other elements of effective instruction. Results also suggest that teachers faced with limited resources can assign students to work together at a computer. While cooperative learning may not always increase student achievement or improve attitude, this study illustrates that cooperative learning may be as effective as individual learning when students use well-designed CBI.

Since teachers often group students together to use computers, it is important for educational technologists to determine the factors that influence outcomes in these settings. Future research should continue to investigate the design elements that influence learning and motivation when students work together to implement computer-based instruction. Future research should also continue to explore the use of well-designed computer instruction in classroom environments. As computer resources become more available in schools, educational technologists must continue to find ways to maximize the effect that computer-based instruction has on learning.

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