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The Effects of Group Situation and Reward Structure on Attitudes and Achievement Gains of Students Using the Micro-computer

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ABSTRACT

The Effects of Group Situation and Reward Structure on Attitudes and Achievement Gains of Students Using the Micro-computer

This is a field study on the effects of reward structure (cooperative or individualistic) and work situation (group or individual) on the achievement and attitudes of students working on the microcomputer. The subjects in this study were one hundred and fifty-three grade six and seven students from an elementary school in a suburban Montreal school board.

The students were randomly assigned to one of the four conditions: individual work under a cooperative reward structure, group work under a cooperative reward structure, individual work under an individualistic reward structure, or group work under an individualistic reward structure. Students used Word Attack, a vocabulary building computer program, for two half-hour sessions to learn twenty-five new words.

The results showed no significant differences among the four conditions on achievement scores. As predicted, students showed equal achievement when working in groups and individually. There was no significant relationship between reward structure and achievement.

All the students indicated that they enjoyed working on the computer. Students who worked under a cooperative reward structure indicated that they enjoyed the task more than did those who worked under an individualistic reward structure.

The implications of these results for research and educational practice are discussed.

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INTRODUCTION

Education today involves the melding of a wide assortment of various strategies and theories. There are new and "improved" methods of teaching emerging everyday, these mostly being variations on old themes; nevertheless each must be evaluated in light of the students and school systems of today. Two of the current teaching methods are computer-assisted instruction and cooperative learning. Computer-assisted instruction includes, in the broadest sense, any instructional situation wherein students use a computer. In its most restrictive sense computer-assisted instruction occurs when students learn and practice new material totally on a computer.

Not only does computer-assisted instruction vary by the amount of time spent actually using the computer, the form of software used also varies widely. There are several types of software including: drill and practice, problem solving, and simulation.

In this study computer-assisted instruction included instruction, practice, and remediation provided solely by

the computer. Word Attack is a piece of drill and practice software. New vocabulary was introduced to the students by the computer, via the software Word Attack. The students learned new words and practiced their use and spelling on the computer. They had no other form of supplemental instruction.

The operational definitions of cooperative learning also extend across a wide range of situations, from any activity in which students work together in groups, to the situation in which students work together towards a common goal and are rewarded only if all the members of the group attain the appropriate level of competence in the specific area.

Traditional teaching, for the purposes of this paper, is being defined as teacher-directed whole-class instruction. The teacher lectures to the students and gives supportive written material. Typically the teacher asks questions and students raise their hands to indicate that they have a response. There is usually a high student:teacher ratio allowing for limited individual interaction. Instruction in the class is not individualized, it is adjusted to the rate of learning, and needs of the many often outweigh those of the few.

Research has shown that computer-assisted instruction can be a powerful supplement to traditional teaching methods. The computer can provide immediate feedback and

remediation as well as the opportunity for a student to engage in varied and indepth practice of a subject or skill area. Computer-assisted instruction has been found to increase achievement (Bangert-Drowns, Kulik & Kulik, 1985). It has been found that students who use the computer to learn enjoy their task more than do those who do not use the computer (Hasselbring, 1986; Kulik, 1983). These students also tend to need less time to learn the presented material and are more likely to interact with their classmates during instruction than are students who receive traditional instruction (Kulik, 1983).

Though computers are becoming commonplace in schools today it is not unusual for a school to have only a few computers, not enough for every student in a class to have one to him or herself. As there are usually not enough computers available for students to work alone teachers are being forced to have students work in groups on the computer.

Research on groups, in general, has shown that the manner in which a group is formed and the reward structure under which the group functions contributes to the effectiveness of the group. Groups which operate under a cooperative reward structure tend to show greater levels of achievement than do those which work under a competitive or an individualistic reward structure (Johnson & Johnson, 1978-79; Slavin, 1980). Students who work within a

cooperative reward structure not only learn more than do their counterparts, they also enjoy their task more (Slavin, 1980). Their social skill development is greater as is their tolerance for others who are different from themselves (Slavin, 1980).

The literature on cooperative learning suggests that heterogeneous ability groups provide the greatest opportunity for personal and academic growth (Johnson and Johnson, 1985). Differing ability levels provide the opportunity for helping behaviours and for peer instruction. Students in a cooperative group work together towards a common goal, this working together tends to increase the students' liking for each other, as well as increasing their self-esteem and self-worth.

Johnson, Johnson, and Stanne (1985, 1986) conducted a study in which they attempted to explore the effects of reward structure on groups using computer-assisted instruction. Though the results from this study indicate that cooperative reward structures are more effective for fostering achievement than are competitive and individualistic reward structures, there are several flaws in the study which diminish the strength of their findings. It is not clear whether the learning situation that Johnson et al. arranged should actually be designated as computer-assisted instruction. The students in the study used the computer for record keeping and feedback purposes but the

majority of their time was spent doing seatwork. The actual instruction portion of the study occurred when students were at their seats not at the computer.

Though Johnson et al. contend that the students were involved in group computer work it is not clear whether any of the students in fact worked together at the computer. The independent variable in this study was reward structure, competitive, cooperative or individualistic. As students did not necessarily work in groups, grouping is confounded with reward structure. The students in the individualistic and the competitive groups definitely did not go to the computer together, nor did they do their seatwork together. There is no indication that the students in the cooperative groups worked at the computer together either. Thus the relevance of the results of the Johnson, Johnson, and Stanne study to one investigating the effects of reward structure and group or individual learning using computer-assisted instruction is in question.

It has been found that both computer-assisted instruction and cooperative reward structures tend to increase academic achievement and enjoyment of task. The number of computers in schools dictates that students usually cannot work alone at the computer (Fazio & Berenty, 1983). Webb (1982a) indicates that there is no indication that group computer use is any less effective than is individual computer work. If this is the case, and in light

of the advantages of group work in general (e.g., enhanced achievement, development of interpersonal interaction skills), it would seem reasonable that group computer-assisted instruction used under a cooperative reward structure may be a very effective means of using the computer. If, on the other hand, computer-assisted instruction is only effective for individuals then the notion of group work should be dropped. It does not make sense to use groups on the computer if the effectiveness of that mode of instruction is sacrificed. This study will explore individual versus group use of the computer and the relationship among these working situations (individual work or group work), and reward structure (cooperative or individualistic).

LITERATURE REVIEW

Computer-Assisted Instruction

Originally computers, and computer software, were designed to be used by one person working at the computer alone. The design of these systems was based on theories of programmed and individualized instruction and modelled after Skinnerian teaching machines (Bork, 1985; Kulik, 1983). These machines provided immediate feedback on the given response, individualized pacing and remediation and user control of the equipment. The microcomputer, when used for computer-assisted instruction (CAI), exceeds the flexibility and individualization of earlier models of the teaching machine. Not only does the computer fulfil the original objectives of the teaching machine it also provides "better, more comfortable, and faster learning; opportunities to work with vastly richer materials and more sophisticated problems" (Kulik, 1983, p. 19).

Research has found that computer-assisted instruction is superior to traditional instruction in several ways (e.g., Bangert-Drowns, Kulik & Kulik, 1986a,1986b; Hasselbring, 1986; Kulik, 1983; Niemic & Walber, 1985). Johnson, Johnson and Stanne (1985, 1986), and others (e.g., Chalip & Chalip, 1978; Clements & Nastasi, 1988; Johnson, Maruyama, Johnson, Nelson & Skon, 1981; Slavin, 1980) have

found that computer-assisted instruction promoted a higher quality and quantity of achievement than did traditional teaching methods. Not only was more information learned in less time, but the students were found to be more highly motivated, had a greater mastery of the factual information learned and were able to apply that learned information in problem-solving situations better than could traditionally taught students. In their recent reviews of the literature on CAI, Kulik (1983), Kulik and Kulik (1986a; 1986b; 1987) and Hasselbring (1986) found similar results. CAI was found to have positive effects on students in the areas of achievement, attitudes, and speed of learning. Kulik (1983) reported that the average effect of CAI was to raise students' test scores by .32 standard deviations (SD) and that the mean decrease in the time needed for instruction was sixty percent.

Computer-Assisted Instruction and Social Interaction

When computers were introduced into educational settings it was feared, as the roots of the development of the computer assisted instruction had been based in individualized instruction, that computer usage would socially isolate students. As social interaction is an important component of cognitive and personal growth,

(Clements and Nastasi, 1988) it is important for the educational setting to promote rather than hinder the social interaction and development of students. Accordingly much of the early research on the effects of computer use in schools focused on social interaction during use. It has been demonstrated consistently (e.g., Clements and Nastasi, 1988; Nida, Lipiniski, Shade, & Watson, 1984; Shade, Nida, Lipiniski, & Watson, 1986) that computer use did not discourage nor reduce social interaction, that in fact in many cases it encouraged and increased social interaction and helping behaviour. Hasselbring (1986) suggests computers provide good opportunities for social interaction and collaboration and he states that :

> The computer may provide a context in classrooms where children recognize each other as helping resources. Thus it would seem that the personal computer may actually enhance the social development of youngsters in the classroom rather than inhibit social development as some have suggested. (p. 321)

Though CAI was originally designed for individual use, the concern for social interaction and the limited number of computers available in the schools has created a situation wherein this rarely occurs, (Fazio & Berenty, 1983; Johnson, Johnson and Stanne, 1985; Shade et al., 1986). Students are

often forced to use computers in pairs or groups. Johnson et al. (1986) and others have found that students working in groups often show greater achievement gains than do classmates who work alone. These gains, were tied to the type of reward structure used in the group setting.

Reward Structure

The term, reward structure, refers to the contingencies upon which a reward for a particular task rests; not to whether or not the students are working in groups. The three types of reward structures used most often in the educational system today are: the competitive reward structure, the individualistic reward structure and the cooperative reward structure. In a competitive reward structure a student's grade is negatively tied to that of his or her classmates; if he or she achieves their goal the chances of his or her classmates achieving their goal is reduced. A competitive reward structure exists when students are graded relative to each other. An example of this is seen when students are graded on a normal curve; only a specific percentage of the class can attain the highest score in this situation. In an individualistic reward structure a student's achievement is in no manner tied to that of his or her classmates. This is a criterion

based system where a student attempts to reach specific, previously selected levels or is compared to his or her own previous work. In this situation a student's score or grade is not related to that attained by his or her classmates, any student who reaches or passes the set criterion can get a high grade. In a cooperative reward structure a student's attainment of their goal is positively tied to that of his or her classmates; that is, if they attain their goals the chance that their classmates will also attain the goal is increased. In this condition students' goals are tied together. An example of this cooperative reward structure is when a group of students split a task into component parts and one member is responsible for each part. The team is successful if all students do their part, thus as each student finishes his component it increases the chance that the group will successful. A positive relationship between classmates also means that if one student does not do his or her part the chances of his or her group succeeding is decreased.

It has been found (Johnson, Maruyama, Johnson, Nelson & Skon, 1981; Slavin, 1980, 1984), that cooperative reward structures tend to produce greater achievement gains in group learning than do individualistic or competitive reward structures. Students working within a cooperative reward structure also tend to be more motivated and enjoy the task more than do students working under a competitive or

individualistic reward structure (Slavin, 1980).

Cooperative learning situations have been found to do more than enhance the achievement of students. The studies on the effects of cooperative learning on social skills and social interaction have found that cooperative learning conditions tend to foster positive interpersonal relationships among students (Johnson & Johnson, 1985; Kagan, 1985; Kagan, Zahn, Widaman, Schwarzwald, & Tyrrell, 1985). Students learn to respect and like their classmates more when they work together in a cooperative situation (Slavin, 1985). Pepitone (1985) found that students who had participated in a cooperative learning situation had better understanding and empathy for their classmates when compared with those students who participated in a traditional or individualistic learning situation. Nijhof and Kommer (1985) found that students in cooperative learning conditions showed improved communication with their classmates. Schmuck (1985), Nijhof and Kommer (1985), and Kagan et al. (1985) suggest that the role of the school is not only one of academic instruction but also one of aiding students in developing life skills. As our world becomes more populated there is a greater need for individuals to know how to live harmoniously with others, to cooperate in achieving common goals (Schmuck, 1985). Johnson, Maruyama, Johnson, Nelson, and Skon (1981) and Slavin (1980), in their reviews of the cooperative learning research, found that

cooperative learning is equal to and usually greater in enhancing and promoting achievement than are traditional methods of classroom instruction. If the achievement of students working cooperatively is not significantly worse (and in most cases it has been found to be better) and cooperative work aids in the development of more social and life skills than do traditional classroom instructional methods, it would seem that whenever feasible cooperative learning would be the preferred mode of instruction.

Johnson, Maruyama, Johnson, Nelson, and Skon

Johnson et al. (1981) conducted a meta-analysis to determine the effects of reward structure on achievement. They analyzed data pertaining to four reward structures: cooperation, cooperation with intergroup competition, interpersonal competition, and individualism. The studies they included in their analyses included all North American investigations which compared two or more reward structures and contained performance or achievement data. The purpose of their meta-analyses was to explore the effects of differing reward structures on achievement.

Johnson et al. found no difference between cooperation and cooperation with intergroup competition, (cooperative teams competing with each other). That is it did not seem to make a difference, when the group worked under a cooperative reward structure, whether groups within the

class competed. Cooperation was found to be superior to competition in promoting achievement. The performance of the average student in the cooperative condition was .75 SD above his or her counterpart in the competitive condition. There was some support for the notion that cooperation with interteam competition, was superior to interpersonal competition (individuals competing with each other), but pure cooperation was found to be the best. Individualism (individuals working alone having work related to their classmates in no manner), was found to be less effective than cooperation. The average student working individually was found to be .75 SD below the average student working cooperatively. There was no significant difference found between those students who worked individually and those who competed interpersonally.

The overall conclusions the authors came to were:

1) cooperation promotes greater achievement than does competition.

2) cooperative efforts are superior, in fostering achievement, to individualistic efforts.

3) Intergroup competition in the cooperative groups promotes less achievement than does cooperation without intergroup competition.

4) The effects, on achievement, of a competitive reward structure are not significantly different than are those of an individualistic reward structure.

Slavin

Slavin's 1980 review of the cooperative learning literature focused on a more restricted body of literature than did the Johnson, Maruyama, Johnson, Nelson, and Skon 1981 meta-analysis. Slavin only looked at studies where the intervention was two weeks or longer and where the classes involved were elementary or secondary school level, Johnson et al. had no such restrictions on their choice of studies. Slavin looked at two aspects of group work, group cohesiveness and achievement. He compared specific cooperative learning strategies for their effectiveness and he also looked into general effects of cooperative learning on achievement and group cohesiveness. As his results related to specific strategies are not relevant to the proposed study only those related to the larger general area of cooperative learning will be summarized here.

Results

Slavin concluded that cooperative learning has positive effects on achievement and is, in most cases, better than, or at worst equal to, traditional class instruction. His findings indicate that intergroup competition can, at times, increase achievement but that it appeared that the more important factor in these cases was the group reward system rather than the competition. The results held whether or not intergroup competition was included in the cooperative

learning situation. He also found positive effects of group cooperative learning for race relations and mutual concern, subcategories of group cohesion. Slavin's results indicate that students tend to have increased self-esteem when they participate in cooperative group work. Slavin also concluded that students who were involved in cooperative learning enjoyed their task and school more than did those students who were taught in traditional classroom settings.

Group Computer Use

Since computers and most computer software were originally designed to be used by individuals, we must ascertain whether or not working alone at the computer is the method of usage which will promote the greatest gains in terms of achievement, attitude, and social skill development. Though the origins of CAI can be found in individualized instruction there is nothing in the literature that suggests that group work on the computer is less effective, in terms of achievement gains, than is individual work (e.g., Baron, Abrami, Wasserman, 1986; Webb, 1985a, 1985b). Baron and Abrami (under review) compared the achievement of individuals, groups of two students and groups of four students working together on the computer and found that group size did not significantly influence

student achievement. Guntermann and Tovar (1987) found that individuals, groups of two and groups of three students all had similar levels of production when programming in LOGO.

The cooperative learning literature strongly states that group work is equal to or more effective than individual work. Students not only tend to learn more in groups but they also tend to enjoy the task more (Johnson & Johnson, 1985; Slavin, 1985). Research has also shown that using a cooperative reward structure fosters greater gains in achievement than does using an individualistic or a competitive reward structure (Johnson, Maruyama, Johnson, Nelson & Skon, 1981; Slavin, 1984). The question of whether these findings generalize to group work on the computer remains unanswered.

Group CAI Within a Cooperative Reward Structure

At times cooperative learning takes longer than traditional methods of instruction (Dishon and O'Leary, 1984). CAI has been found to decrease the time that students needed to learn material (Edwards, Norton, Taylor, Weiss & Dusseldorp, 1975; Hasselbring, 1986; Jamison, Suppes & Wells, 1974; Kulik & Kulik, 1986a, 1986b, 1987). The benefit of less time needed for instruction, found with CAI

may outweigh the drawback of the slower pace found with cooperative group work. Both CAI and cooperative learning have been found to increase students' motivation, attitudes and enjoyment of the learning task, (Kulik & Kulik, 1986a, 1987; Johnson, Maruyama, Johnson, Nelson & Skon, 1981; Slavin, 1984). Increased social interaction occurs in both CAI (Hasselbring, 1986) and cooperative learning environments (Kagan, 1985). Therefore not only should the students working on the computer in groups make greater gains in achievement than do those who work alone but they should also develop better social skills and attitudes towards academic tasks.

Johnson, Johnson, and Stanne

Johnson, Johnson and Stanne's 1985 and 1986 research projects were designed to investigate "the relative efficacy of computer-assisted cooperative, competitive, and individualistic learning" (1985, p. 668). The independent variables studied were type of learning; cooperative, competitive or individualistic, and gender. The dependent variables were: achievement, as measured by worksheets and a final test; interaction patterns related to the task, as measured by observation; attributions associated with the subject matter and with the instructional experience, as measured by several questionnaire type scales; and relationships among the students, as measured by a

sociometric instrument.

Software and Computer Roles

The software Johnson et al. used was a modified version of Geography Search (Snyder, 1982). All students were trained how to use the program and were given supplemental written materials on map reading and navigational skills. The aim of the program was to sail a ship to the New World where gold could be obtained. The navigation of the ship was to be done using the sun, stars, climate, trade winds, and ocean depth. The computer was used to provide information on the effects of the action the students decided on and to record the students' decisions. The computer was to be used as a supplement to decision making, problem solving and the written materials.

Team and Condition Assignment

The three conditions studied were cooperative learning, competitive learning and individualistic learning. It is not clear how the students were assigned to conditions. Within each condition the students were randomly assigned to heterogeneous ability and gender teams of four.

The Cooperative Learning Condition

The students in the cooperative condition were told to work together. They were told to obtain as much gold they

could, and that everyone in the group must learn to read maps and how to navigate. They were also told that the team score would be an average of the individuals' scores on the test and on the worksheets and bonuses would be given for speed both for the team and for the class as a whole. Specific sub-task related roles (e.g., captain, quarter-master, navigator, and meteorologist) were assigned and rotated daily. Daily performance feedback was given to the teams. The role of the teacher was to supervise the teams to see that roles were maintained and that suitable cooperative behaviours were taking place.

The Competitive Learning Condition

The students in the competitive learning condition were told "to compete to see who was best" (p. 671). In this condition there was intrateam competition and intraclass competition. The students were told that they would each have to fill in daily worksheets and take a final test. They were also told that they would be graded according to whether they had placed first, second, third or fourth in their group and that they would receive a bonus if they were the fastest one in the class to complete the voyage and/or the worksheets. A chart was used to show the class who was winning. Students were told to be fair about the amount of time they used the computer. The students were told to compare their performance with the others in their team but

not to work nor interact with them. The role of the teacher was to supervise the teams to see that appropriate competitive and noninteractive behaviours were taking place.

The Individualistic Learning Condition

The students in the individualistic learning condition were told that they would each have to fill in a daily worksheet and take a final test. They were told that their grade would be determined by how well they did as compared with a pre-set standard of excellent performance. That they could get bonus points for specific amounts of gold collected and for 'reaching land' in a specific time limit. Daily feedback was given in the form of confidential teacher-student correspondence. The students were told not to interact with their team-mates and to work hard to reach the pre-set goal levels. The role of the teacher was to supervise the teams to see that suitable noninteractive individualistic behaviours were taking place.

Results

The findings of this study indicate that students in the computer-assisted cooperative learning condition made greater gains in achievement than did those in either the individualistic or the competitive learning conditions. Cooperative learning was found to foster greater motivation and more successful problem-solving than did the other

conditions. Students in the competitive and individualistic learning conditions were found to be less motivated and enjoyed the task less than did their cooperative learning condition counterparts.

Critique

The operationalization of the cooperative, competitive and individualistic reward structures that Johnson et al. used in their study is basically within the generally accepted framework set out in the cooperative learning literature (see Kagan, 1985; Slavin, 1985). The instructions to the students were explicit. The teacher's role was to ensure that behaviours appropriate to the particular condition took place.

Johnson, Johnson, and Stanne state that "it is inevitable that students work with the computers in small groups" (p. 668) due to the lack of computers in most schools. Their study does not seem to investigate this situation but rather compares groups which used the computer as one of several learning materials with individuals who used the computer for the same purpose. They proposed to study the interactions of students working in groups at the computer but instructed two thirds of their sample not to interact with one another. Students are not usually put into groups and then told not to work together. It is not clear, with the exception of the cooperative condition, what

the point of putting the students in groups was in this study. The instructions given to the students provide specific directions as to the appropriate behaviour to be exhibited, but it does not appear that these necessarily created actual group situations. It should not be surprising that the students who were in groups which were allowed, and encouraged, to interact enjoyed the task more than did those who were not allowed to interact.

The cooperative learning groups in Johnson et al.'s study accumulated significantly greater amounts of gold than did those groups in either the competitive or the individualistic learning conditions, an average of 77.88 units of gold for the cooperative groups versus 18.47 for the competitive groups and 10.03 for the individualistic groups. It could be that the cooperative learning groups made greater achievement gains inpart because they received so much more reinforcement, in terms of gold received, than did the groups in the other conditions.

Though Johnson, Johnson, and Stanne set out to study "the relative efficacy of computer-assisted cooperative, competitive, and individualistic learning" (1985, p. 668), their cooperative learning condition was in actuality an example of group investigation with the computer included as a small part of that situational arrangement. They investigated a computer-assisted learning situation only in the broadest sense. The learning situation in their study

consisted of students working away from the computer in groups and only using the computer "to record their decisions and give feedback on the consequences" (p. 671) of those decisions. In Johnson et al.'s own words the computer was used as "an adjunct" (p. 671) to the students' group work and the written materials. The students only went to the computer after they had decided what action to take. The computer informed them of the consequences of this action. The students then returned to their group area, away from the computer, to use written materials to plan their next move.

Johnson, Johnson, and Stanne provide a very strong case for the superiority of cooperative learning, as compared to competitive and individualistic learning. The basis for this conclusion is that there is more discussion, controversy and ultimately more sharing of ideas and opinions than there is in the other two strategies. If students in both the competitive and the individualistic groups are told not to interact (this is how Johnson et al. structured their experimental conditions) is it not to be expected that students in a cooperative learning situation will engage in more of the mentioned behaviours? If so does a discussion of the relative presence of these factors add to our information about cooperative learning? Does the Johnson definition actually relate to what would go on in competitive and individualistic groups if no specific

limitations were enforced?

Johnson et al. state that the discussion process is important for learning, specifically for memorization and subsequent increased achievement. They have restricted the interaction, and subsequent discussion, of the students in the individualistic and the competitive learning situations. It would stand to reason that students in these conditions would engage in some sort of interaction if they had not been specifically instructed not to do so. If Johnson et al. are correct in their contention that discussion is needed for and/or enhances learning and resulting achievement they have designed a situation that will obviously favour those students who are allowed to interact. The results favouring the students in the cooperative learning condition may be an indication of the contrived situation rather than actual differences in the effects of differing reward structures on students working in groups.

It seems that the subjects in Johnson et al.'s study spent the majority of their time away from the computer. The instruction in map reading skills and navigation took place at tables away from the computer. The computer recorded the students' choices and gave information as to the repercussions of those choices but it did not provide any actual instruction. The computer served more of a testing role than a teaching role.

The groups in this study did not necessarily work on

the computer as a group. Individualistic and competitive groups were instructed to "play fair by observing the time limits on the computer" (p. 671). The students in the competitive learning and the individualistic learning groups worked on their own at the tables and then went alone to the computer. Though placed in teams of four those students in the competitive and individualistic conditions actually worked alone on the computer, as they did at the tables. It is not clear whether the cooperative learning groups went to the computer together or sent one member to enter their choices and return with the feedback from the computer.

The proposed study will involve students working on the computer for the entire session time. In this case the computer will not be an addition to the learning situation, rather it will be the mode of instruction, all work will be done at/with the computer. Students placed in groups will not be instructed to restrict their interactions. The reward structures will vary among the groups but there will be not explicit instructions in the individualistic groups for students not to interact. All members of a group will work with the computer at the same time.

HYPOTHESES

Hypotheses pertaining to achievement

H_1: Students working alone under an individualistic reward structure will have achievement equal to students working alone under a cooperative reward structure.

The students in the single subject working conditions students worked alone at their computers. In the cooperative reward structure condition the students were told that everyone in the computer room must score above 75% on the posttest to enable anyone in the room to receive a certificate of excellence. The students, though working under a cooperative reward structure had no control nor influence on the behaviour of others in the room. The literature suggests that two of the mechanisms that allow cooperative reward structure to influence students' behaviour, and ultimately their achievement, are peer pressure and peer assistance. The possible influence of these factors is highly restricted by the conditions the students worked under, therefore it was hypothesized that reward structure would not affect student achievement in this situation.

H_2: Students working in a group under a cooperative reward structure will exhibit achievement equal to that of subjects working alone under an individualistic reward structure or a cooperative reward structure.

Computer-assisted instruction was originally designed for individual not group use. The literature dealing with reward structure, in general and not specifically related to computer use, suggests that students who work in a group under a cooperative reward structure will demonstrate enhanced achievement. As stated previously, the effects of reward structure on students working alone on the computer are hypothesized to be minimized by the physical situation in which the students are placed; they have little, if any, opportunity to influence the behaviour of others in the computer room. It was hypothesized that the effects of working on the computer under a cooperative reward structure in a group would counteract the negative effects of working in a group.

H_3: Students using the computer in groups of three under a cooperative reward structure will demonstrate greater achievement than will those students using the computer in groups of three under an individualistic reward structure.

Computer-assisted instruction is based upon principles of individualized instruction and as such was designed to be used by individuals. The effectiveness of computer-assisted instruction is attributed to a variety of factors, individualized timing, feed-back and remediation being three of the most influential factors. Group computer use, by definition, is a situation wherein these factors can no longer work as designed. Students working in a group under a cooperative reward structure are bound together and dependent upon one another. It was hypothesized that students working in groups under a cooperative reward structure would demonstrate higher achievement than those working under an individualistic reward structure.

Hypotheses pertaining to Attitude

H_1: Subjects working on the computer in a group will enjoy the experience more than will those subjects who work on the computer alone.

The literature on group work suggests that students find working together to be more enjoyable than working alone, thus it was hypothesized that group computer work would be rated more favourably than would individual computer work.

H_2: Students working under a cooperative reward structure will enjoy the task more than will those working under an individualistic reward structure.

The literature indicates that students who work under a cooperative reward structures rate their experience more favourably than do students who work under an individualistic reward structure. It was hypothesized that students who worked under a cooperative reward structure would enjoy the task more than those who worked under an individualistic reward structure.

H_3: Students working in a group of three under a cooperative reward structure will enjoy the task more than will subjects in any other condition.

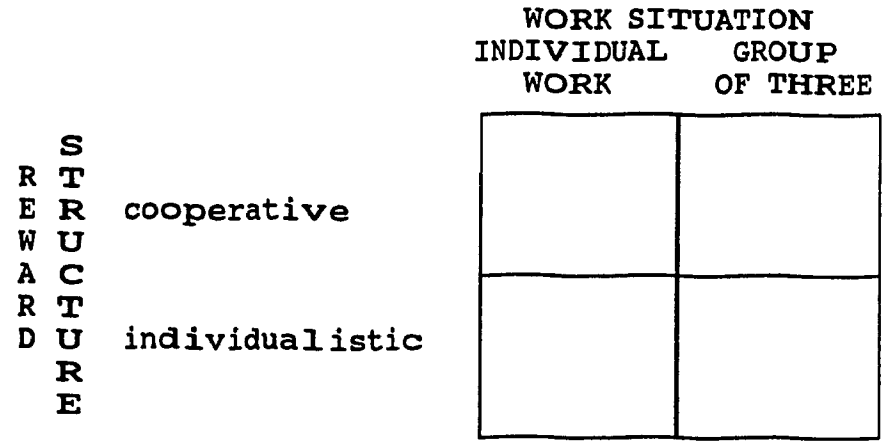
The literature on group versus individual working conditions suggests that the group work situation is the most enjoyable for participants. The reward structure literature indicates that students also prefer working under a cooperative reward structure, as opposed to working under an individualistic reward structure. Thus it was hypothesized that students who worked both in a group and under a cooperative reward structure would enjoy the experience more than would students working under any other condition.

DESIGN

The main design of this study will be a Reward Structure (cooperative, individualistic) by Work Situation (individual work, group work) factorial.

2 X 2 Reward Structure by Work Situation ANOVA

DV = achievement measure(s)
= attitude measure



METHOD

Subjects

The subjects were three grade six and three grade seven classes, approximately 164 students, from Edgewater Elementary School in Pincourt, a suburb of Montreal. All subjects had experience using computers but not using the specific program Word Attack (Davidson and Associates, 1983).

Pretest

The students were given the Basic Word Vocabulary Test (BWVT) (Jamestown Publishers, 1975), a standardized vocabulary test, pretreatment, in class to determine their initial vocabulary levels. The BWVT is an untimed test in which subjects are required to read a word or a segment of a sentence and choose the word, from a list of five given words, which has the same meaning. The internal-consistency coefficient for BWVT is reported at .96, with a standard error of 3.0 raw score points. The test can be considered to be equivalent to an IQ test and has a reported concurrent validity with the School and College Ability Tests (SCAT)

and the Sequential Tests of Educational Progress (STEP) ranging from .46 to .84.

The scores from this test were used to assign students to heterogeneous ability groups and were used as covariates in statistical analyses.

Condition Assignment

Within each class, one half of the students were randomly assigned to either the single subject individualistic reward structure (SSIR) condition or the single subject, cooperative reward structure (SSCR) condition. As the assignment was random one can assume to have subjects from all ability levels represented in these conditions. The remaining students were assigned to heterogenous ability groups of three, using their BWVT scores. The groups were randomly assigned to either the three subject group, individualistic reward structure (TSIR) condition; or the three subject group, cooperative reward structure (TSCR) condition.

Three has been chosen for the size of the groups due to the physical constraints of the computer environment. Three students can easily sit in a manner that allows each of them fairly easy access to the keyboard. When four students attempt to use the computer it is much more difficult to

come up with an arrangement which gives each student access to the keyboard. The size of the computer screen also makes it difficult to accommodate four viewers.

Software

A vocabulary building software package, Word Attack was used for vocabulary instruction. This program consists of four different levels of instruction and practice. The first level is a tutorial, in this level the students are introduced to the words, their meaning and appropriate use in a sentence. The second level is a drill and practice exercise in a multiple choice type format, the students are presented with a word and are given four possible definitions to choose from. The third level involves sentence completion. The students are given an incomplete sentence and they must type in the missing word. A help option is available for this level, if students can not come up with the appropriate word they can ask for help and are given a list of four words to choose from. The student has two chances to give the correct answer, in both the second and third levels, after which the correct response is given. The students are provided with a list of missed words at the end of each level and given the opportunity for remedial practice. The students can repeat any level at any time.

The fourth level consists of an arcade type game in which the students have to provide the correct definition of a given word to obtain points. Word Attack has nine levels of vocabulary words, aimed at students from grades five through twelve. Word Attack has clear on-screen directions and can be used with little or no previous computer experience.

This software has also been chosen as it has academic applicability and its effectiveness in teaching vocabulary can be easily measured with a pen and paper test. Word Attack has been given a rating of 9/10 for instructional design and of 8/10 for software design by EPIE (1983). The 1983 EPIE review of Word Attack states that the program is appropriate for grades five through twelve, that it is clear, accurate and has simple but appealing graphics. Davidson and Associates tested the effectiveness of this program on students and found that their vocabularies increased significantly (1983, 1985).

Implementation

Each class was split into four sections for the time spent working on the computers. Each section consisted of all the groups in a condition, eg. all the single subject individualistic reward structure (SSIR) subjects in one class worked on the computer at the same time. This was

done so that subjects in each condition only encountered subjects working under similar conditions when they were working on the computer. That is, there was not one group working together cooperatively at one computer while there was an individual working at the next computer.

Each section spent two half-hour sessions working on a computer using the vocabulary building software. Two sessions were scheduled, this was done to allow the subjects adequate time to become comfortable with the software, to learn, and to practice the vocabulary material.

Included in the first session was instructions as to how the groups and rewards worked. The instructions were read from a prepared script[1] to ensure that instructions were the same for all classes. The SSIR subjects were told that they were to work alone on their computer and that at the end of the sessions they would be given a test to see how well they had learned the vocabulary. They were told that all students who received 75% or greater on the final test would receive a reward. The SSCR subjects were told that they were to work with their own computer and at the end of the sessions they would be given a test to see how well they learned the vocabulary. They were told that if all students received 75% or greater on the final test everyone would receive a reward. These students were

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[1] for script of instructions given to students see Appendix 1.

working within a cooperative reward structure but not in a group work situation. The three subject group individualistic reward structure (TSIR) subjects were told to work with the software and that after the sessions they would each be given a test to see how well they learned the vocabulary. These students were told that all students who received 75% or greater on the final test would receive a reward. The three subject group cooperative reward structure (TSCR) subjects were told to work together in their groups on the computer. They were told that they would be given a test at the end of the sessions and that they would receive a reward if the average score of the group's members individual scores was 75% or greater. This created a situation of individual accountability and intrateam interdependence, each student equally influencing the group's score. For the group to succeed all members must learn the material.

Because of the nature of computer-assisted instruction the subjects received constant feedback on their performance and received immediate, appropriate remediation.

A pen and paper vocabulary posttest and an attitudinal measure was given in class after all sections had completed the sessions.

Rewards

The rewards consisted of an award of academic excellence, a brightly coloured certificate with the student's name printed on it, and a newsletter that was distributed to the whole class. The certificate was fashioned after those typically used by the school.

Posttests

The students were given a pen and paper vocabulary test[2], based on the words introduced in the sessions, in class after all sections completed their two sessions. The test consisted of twenty-five multiple choice and twenty-five sentence completion questions, in a format similar to that used in Word Attack.

For the multiple choice portion of the test the students were presented with a word and had to choose the appropriate definition from a list of four possible definitions. The student circled the letter corresponding to the correct response. In the sentence completion portion of the test the students were given a partial sentence and had to fill in the appropriate missing word.

After completing both the multiple choice and the

[2]See Appendix 4 for Achievement Posttest

sentence completion tests the students were asked to fill out a questionnaire[3] about their experiences using Word Attack specifically and their computer experience in general.

[3]See Appendix 3 for Attitudinal Questionnaire

RESULTS

The data analyses are divided into two sections, a brief overview and conclusions. The first section includes the analyses of the achievement test data. The second section deals with the analyses of the attitudinal data.

Overview

As predicted the analyses of the achievement data failed to reject the null hypotheses that reward condition would not affect the achievement of students who worked alone, and that groups working under a cooperative reward structure would achieve the same results as would individuals working under either reward structure. The hypothesis that reward structure would affect the achievement of groups was not supported.

Analyses of the attitudinal measure indicated that the students enjoyed their computer learning experience and were willing to participate in another such experience. The hypothesis that reward structure would influence the enjoyment of the experience was supported. The predicted effect of situation on enjoyment was not supported. Nor was an interaction between reward structure and situation found. The detailed results of these analyses are reported in the following sections.

Analyses of Achievement Data

Pretest

To determine any existing pretreatment differences in vocabulary level a 2 (reward, REW) by 2 (situation, SIT) analysis of variance (ANOVA) on the Basic Word Vocabulary Test, (BWVT), the pretreatment measure, was carried out. This analysis found no differences between reward, $F(1,140)=0.489$, $p>.05$, or situation, $F(1,140)=0.536$, $p>.05$ conditions on initial vocabulary ability. Mean BWVT scores can be found in Table 1.

Posttests

Students tended to do very well (the highest possible score on both tests was 25) on the multiple choice posttest (MC), the grand mean was 20.64 , and not very well on the sentence completion posttest (SC), the grand mean was 9.32. Mean scores on the posttests can be found in Table 2 for MC, and Table 3 for SC. The ANOVA on the multiple choice posttest indicated no significant effect for reward, $F(1,140)=1.310$, $p>.05$, or situation, $F(1,140)=0.108$, $p>.05$. The analyses of the sentence completion posttest also found no differences among conditions; for reward, $F(1,140)=0.771$, $p>.05$; for situation, $F(1,140)=0.057$, $p>.05$. (See Tables 4 and 5).

As predicted the results fail to reject the null

hypothesis that there would be no differences found between students working alone, whether under a cooperative or an individualistic reward structure. These analyses also fail to reject the null hypothesis that students working in a cooperative group would demonstrate the same achievement as would those working alone on the computer. The hypothesis that students who work in groups of three under a cooperative reward structure would show greater achievement than would those students working in a group of three under an individualistic reward structure was not supported by the analyses.

Though there were no significant pre-existing differences among the conditions there was a great deal of within group variance, as evidenced by the mean squared error terms for the above analyses, 20.540 and 48.416, respectively. In an attempt to reduce within group variance the BWVT was used as a covariate. In the analyses of covariance, ANCOVA, the mean square error terms were reduced to 14.481 for MC and 39.069 for SC. Although the error terms were reduced the pattern of results did not change. No significant main effects nor interactions were found. MC, reward, $F(1,135)=.476$, $p>.05$; situation, $F(1,139)=.259$, $p>.05$. SC, reward $F(1,139)=.389$, $p>.05$; situation $F(1,135)=.253$, $p>.05$. (See Tables 6 & 7 for ANCOVA results)

Analyses of Attitudinal Data

Four of the attitudinal items (See Table 8 for specific attitudinal item questions) asked the subjects to rate their enjoyment of their learning experience. In each of the experimental conditions, subjects' mean responses indicated that they enjoyed the experience and were willing to use the computer again. Item 5 asked the subjects if they enjoyed using the computer. Subjects indicated that they had, the grand mean rating for this item was 4.72, where 5 is the most favourable rating. Item 12 asked the subjects if they enjoyed using the computer, specifically, to learn new words; the grand mean score for this item was 3.98. The grand mean rating for item 2, (Was Word Attack fun?), was 4.31 and for item 17 (Would you like to use Word Attack again?) was 4.32. Overall the experience seemed to have been a positive one for the participants, as indicated by the specific items and by a willingness to engage in the activity again. (See Table 9 for means and standard deviations and Tables 10 - 25 for the analyses of variance for attitudinal items)

Analyses of nine items designed to access satisfaction of situation indicated a preference for condition, that is those subjects working alone tended to prefer working alone while those who worked in a group liked working in a group. Though an ANOVA of item 1 (I like to work by myself),

F(1,135)=.352 for reward and F(1,135)=3.385, for situation, did not reveal significant differences, p>.05, among conditions ANOVAs calculated on items 3, (I would like to work on the computer in a group), 6, (I learn more if I work by myself), 9, (I enjoy learning more when I have people to work with), 11, (If I had the choice I would choose to use the computer: 1) alone; 2) with a group), 14, (I enjoy working in a group), 15, (I would like to work alone at the computer), 16, (I learn more when I work in a group), and 18, (I work best by myself), all indicated a significant effect for situation and no effect for reward (See ANOVA Tables 10, 12, 14, 16, 19, 21, 22, 23, and 25 respectively). In all cases subjects who worked in a group indicated that they felt they learned more and enjoyed the task more while working in a group than they would have if they had been working individually. The subjects that worked individually reacted similarly to their situation, that is they stated that they preferred working individually and felt that they had enjoyed the task and learned more than they would have if they had worked in a group. As indicated by the analyses of the above items, the hypothesis that subjects working on the computer in a group would enjoy the experience more than those subjects working on the computer alone was not supported by the analyses. The hypothesis that students working in a group of three under a cooperative reward structure would enjoy the task more than subjects in all

other conditions was also not supported.

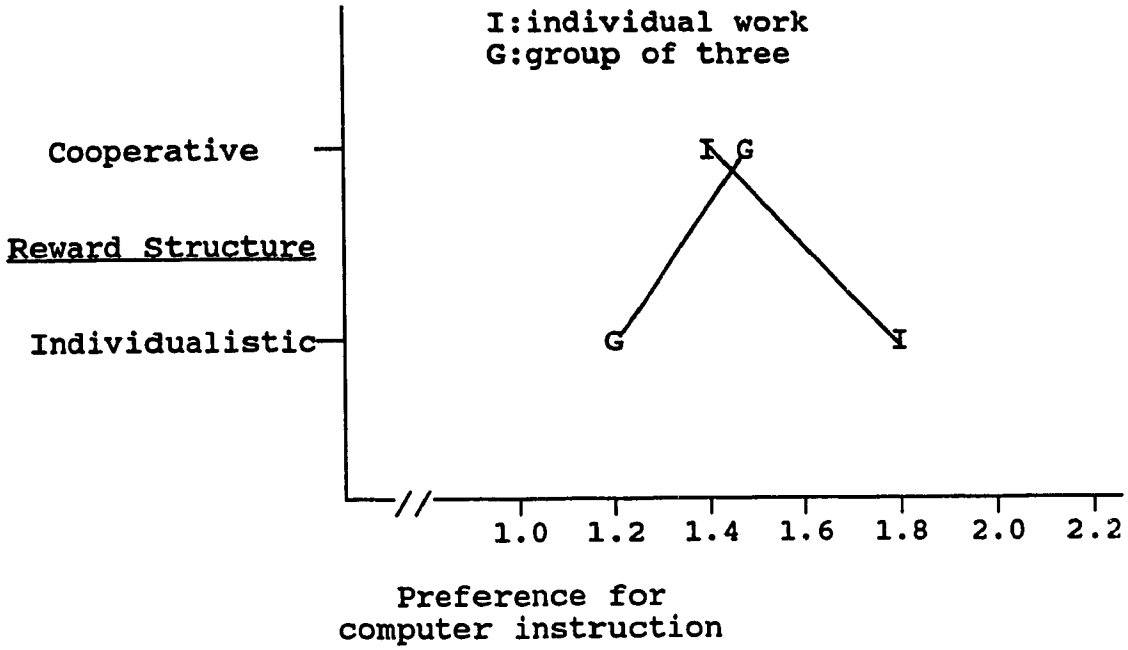
All subjects indicated a preference for computer learning, rather than in class learning, (as measured by item 10, the subjects were asked if they would rather learn new words in class, as opposed to by computer), $\underline{M}$=1.53, where 5 indicated a strong preference for in-class learning. There was a significant interaction between reward condition and situation for the item. (See Table 17 for cell means and standard deviations and Table 18 for ANOVA results)

A graph of the interaction indicates (see Figure 1) that for students working under an individualistic reward structure those who worked in a group preferred computer work more than did those who worked alone. There seems to be little difference between the ratings of those subjects who worked under a cooperative reward structure.

An ANOVA of item8b supported the hypothesis that students working under a cooperative reward structure would enjoy the task more than would those working under an individualistic reward structure, $F(1,95)=4.143$, $p<.05$. This analysis indicated that subjects working under a cooperative reward structure, $\underline{M}$ =2.67, enjoyed their experience, regardless of group or individual work, more than did those who worked under an individualistic reward structure, $\underline{M}$ = 1.97.

Figure 1

Interaction between Reward and Situation for Attitudinal Item 10



Summary

The prediction that reward structure would not affect the posttest achievement scores of students who worked alone was found to be appropriate as was the prediction that cooperative reward groups would exhibit achievement equal to that of individuals. There were no significant effects found for either reward structure, cooperative or individualistic, nor situation, group or individual work. Reward structure did not affect the achievement of groups as predicted.

Analyses of the attitudinal data showed that the students enjoyed the computer learning experience very much and gladly participate in such an experience again.

Though all students indicated a very strong preference for computer learning, versus in class instruction, students who worked under an individualistic reward structure in a group enjoyed the experience more than did those who did so alone.

There was a tendency for students to state a preference for their situational condition, that is students who worked in a group rated group learning more favourably than individual learning and individuals rated individual work higher than they did group work.

Students who worked under a cooperative reward structure rated the experience more positively than did

those students who worked under an individualistic reward structure.

In conclusion, neither reward structure nor situation seemed to affect the post test achievement scores of the students,all preformed equally. Students who worked under a cooperative reward structure seemed to enjoy the experience more than did those who worked under an individualistic reward structure. Situation, individual or group work, did not seem to affect student's enjoyment, students tended to indicate a preference for the situation they were in.

Table 1

Mean Pretest Scores Basic Word Vocabulary Test

		REWARD STRUCTURE					
		Cooperative			Individualistic		
		n	M	SD	n	M	SD
SITUATION	Individual	34	43.29	10.82	37	45.59	12.08
	Group	38	42.81	12.79	35	43.37	10.35

Table 2

Mean Multiple Choice Test Scores

		REWARD STRUCTURE					
		Cooperative			Individualistic		
		n	M	SD	n	M	SD
SITUATION	Individual	37	20.19	4.77	35	20.85	4.65
	Group	37	20.24	4.45	35	21.31	4.32

Table 3

Mean Sentence Completion Test Scores

		REWARD STRUCTURE					
		Cooperative			Individualistic		
		n	M	SD	n	M	SD
SITUATION	Individual	37	8.30	7.25	35	10.11	7.12
	Group	37	9.35	7.00	35	9.57	6.42

Table 4

ANOVA Table for MC:Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	29.446	2	14.723	.709	.494
REWARD	2.250	1	2.250	.108	.742
SIT	27.196	1	27.196	1.310	.254
2-WAY INTERACTIONS	1.461	1	1.461	.070	.791
REWARD SIT	1.461	1	1.461	.070	.791
EXPLAINED	30.907	3	10.302	.496	.685
RESIDUAL	2906.315	140	20.759		
TOTAL	2937.222	143	20.540		

Table 5

ANOVA Table for SC: Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	40.096	2	20.048	.414	.662
REWARD	2.778	1	2.778	.057	.811
SIT	37.318	1	37.318	.771	.381
2-WAY INTERACTIONS	22.933	1	22.933	.474	.492
REWARD SIT	22.933	1	22.933	.474	.492
EXPLAINED	63.029	3	21.010	.434	.729
RESIDUAL	6778.276	140	48.416		
TOTAL	6841.306	143	47.841		

Table 6

ANCOVA Table for MC:Reward by Situation with BWVT

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
COVARIATES	914.715	1	914.715	63.166	.000
BWVT	914.715	1	914.715	63.166	.000
MAIN EFFECTS	10.639	2	5.320	.367	.693
REWARD	6.888	1	6.888	.476	.492
SIT	3.751	1	3.751	.259	.612
2-WAY INTERACTIONS	3.870	1	3.870	.267	.606
REWARD SIT	3.870	1	3.870	.267	.606
EXPLAINED	929.224	4	232.306	16.042	.000
RESIDUAL	1954.947	135	14.481		
TOTAL	2884.171	139	20.749		

Table 7

ANCOVA Table for SC:Reward by Situation with BWVT

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
COVARIATES	1367.751	1	1367.751	35.009	.000
BWVT	1367.751	1	1367.751	35.009	.000
MAIN EFFECTS	25.072	2	12.536	.321	.726
REWARD	15.821	1	15.821	.405	.526
SIT	9.884	1	9.884	.253	.616
2-WAY INTERACTIONS	7.800	1	7.800	.200	.656
REWARD SIT	7.800	1	7.800	.200	.656
EXPLAINED	1400.623	4	350.156	8.963	.000
RESIDUAL	5274.263	135	39.069		
TOTAL	6674.886	139	48.021		

Table 8

Attitudinal Items

Item	Question
1	I like to work by myself.
2	Word Attack was a fun program.
3	I would like to work on the computer in a group.
4	The level of Word Attack that I liked the best was
5	I enjoy using the computer.
6	I learn more if I work by myself.
7	Word Attack made learning the words easy.
8	I used the computer: 1) alone; 2) with a group and I think that this is the best way to use a computer to learn new words.
9	I enjoy learning more when I have people to work with.
10	I would like to learn new words in class rather than by using the computer.
11	If I had the choice I would choose to use the computer: 1) alone; 2) with a group
12	I like using a computer to learn new words.
13	I had enough time to learn the words.
14	I enjoy working in a group.
15	I would like to work alone at the computer.
16	I learn more when I work in a group.
17	I would like to use Word Attack again.
18	I work best by myself.

Table 9

Means and Standard Deviations for Attitudinal Items 1, 2, 3, 5, 6, 7, 8b, 9, 11, 12, 14, 15, 16, 17, and 18*, Dealing with Situational Satisfaction

	SITUATION					
	Individual			Group of 3		
Item	n	M	SD	n	M	SD
1	72	3.40	1.21	71	3.06	1.27
2	72	4.36	.83	72	4.25	.98
3	69	2.85	1.32	74	3.54	1.37
5	72	4.75	.60	72	4.68	.73
6	72	3.74	1.19	72	2.96	1.36
8b	70	2.72	2.67	69	1.91	3.03
9	72	3.08	1.23	71	3.83	1.25
11	70	1.33	.47	67	1.63	.49
12	72	4.00	1.14	71	2.85	1.26
14	70	2.80	1.40	72	3.63	1.14
15	71	3.59	1.39	72	2.96	1.37
16	71	2.62	1.19	72	3.31	1.24
17	71	4.39	.97	72	4.26	1.17
18	71	3.84	1.20	71	3.15	1.33

* items 4, 8, 10, & 13 asked for information that did not pertain to either reward structure nor situation and as such were not used in analyses.

Table 10

ANOVA Table for Attitudinal Item 1 (like to work by self): Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	5.695	2	2.847	1.831	.164
REWARD	.547	1	.547	.352	.554
SIT	5.263	1	5.263	3.385	.068
2-WAY INTERACTIONS	.611	1	.611	.393	.532
REWARD SIT	.611	1	.611	.393	.532
EXPLAINED	6.306	3	2.102	1.352	.260
RESIDUAL	209.881	135	1.555		
TOTAL	216.187	138	1.567		

Table 11

ANOVA Table for Attitudinal Item 2 (word attack is fun): Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	.387	2	.193	.234	.792
REWARD	.154	1	.154	.187	.666
SIT	.246	1	.246	.298	.586
2-WAY INTERACTIONS	2.167	1	2.167	2.623	.108
REWARD SIT	2.167	1	2.167	2.623	.108
EXPLAINED	2.553	3	.851	1.030	.381
RESIDUAL	111.519	135	.826		
TOTAL	114.072	138	.827		

Table 12

ANOVA Table for Attitudinal Item 3 (like to work in group): Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	17.938	2	8.969	4.855	.009
REWARD	1.904	1	1.904	1.031	.312
SIT	15.615	1	15.615	8.453	.004
2-WAY INTERACTIONS	3.622	1	3.622	1.960	.164
REWARD SIT	3.622	1	3.622	1.960	.164
EXPLAINED	21.560	1	7.187	3.890	.011
RESIDUAL	249.390	135	1.847		
TOTAL	270.950	138	1.963		

Table 13

ANOVA Table for Attitudinal Item 5(enjoy using computer) Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	1.022	2	.511	1.022	.363
REWARD	.821	1	.821	1.640	.203
SIT	.232	1	.232	.464	.497
2-WAY INTERACTIONS	.331	1	.331	.661	.418
REWARD SIT	.331	1	.331	.661	.418
EXPLAINED	1.353	3	.451	.901	.442
RESIDUAL	67.553	135	.500		
TOTAL	68.906	138	.499		

Table 14

ANOVA Table for Attitudinal Item 6 (learn more by self): Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	18.139	2	9.069	6.301	.003
REWARD	.838	1	.838	.582	.447
SIT	17.380	1	17.380	12.075	.001
2-WAY INTERACTIONS	3.126	1	3.126	2.172	.144
REWARD SIT	3.126	1	3.126	2.172	.144
EXPLAINED	21.265	3	7.088	4.925	.003
RESIDUAL	136.735	95	1.439		
TOTAL	158.000	98	1.612		

Table 15

ANOVA Table for Attitudinal Item 8b (situation was best to learn words): Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	58.088	2	29.044	3.456	.036
REWARD	34.815	1	34.815	4.143	.045
SIT	22.670	1	22.670	2.698	.104
2-WAY INTERACTIONS	4.182	1	4.182	.498	.482
REWARD SIT	4.182	1	4.182	.498	.482
EXPLAINED	62.271	3	20.757	2.470	.067
RESIDUAL	798.275	95	8.403		
TOTAL	860.545	98	8.781		

Table 16

ANOVA Table for Attitudinal Item 9 (like to learn by self): Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	22.532	2	11.266	7.029	.001
REWARD	3.270	1	3.270	2.040	.156
SIT	19.143	1	19.143	11.943	.001
2-WAY INTERACTIONS	.232	1	.232	.144	.705
REWARD SIT	.232	1	.232	.144	.705
EXPLAINED	22.763	3	7.588	4.734	.004
RESIDUAL	213.178	133	1.603		
TOTAL	235.942	136	1.735		

Table 17

Cell Means and Standard Deviations for Attitudinal Item 10 (like learning in class)

		REWARD			
		Cooperative		Individualistic	
		M	SD	M	SD
SITUATION	Individual	1.49	1.09	1.83	1.42
	Group of three	1.56	1.13	1.26	0.78

Table 18

ANOVA Table for Attitudinal Item 10 (like learning in class) Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	2.225	2	1.113	.866	.423
REWARD	.003	1	.003	.002	.963
SIT	2.224	1	2.224	1.731	.190
2-WAY INTERACTIONS	5.178	1	5.178	4.032	.047
REWARD SIT	5.178	1	5.178	4.032	.047
EXPLAINED	7.403	3	2.468	1.921	.129
RESIDUAL	170.802	133	1.284		
TOTAL	178.204	136	1.310		

Table 19

ANOVA Table for Attitudinal Item 11 (choice of situation): Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	3.186	2	1.593	6.889	.001
REWARD	.140	1	.140	.604	.439
SIT	3.036	1	3.036	13.132	.000
2-WAY INTERACTIONS	.223	1	.223	.966	.327
REWARD SIT	.223	1	.223	.966	.327
EXPLAINED	3.409	3	1.136	4.915	.003
RESIDUAL	30.751	133	.231		
TOTAL	34.161	136	.251		

Table 20

ANOVA Table for Attitudinal Item 12 (like to use computer to learn new words): Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	.551	2	.276	.211	.810
REWARD	.364	1	.364	.278	.599
SIT	.191	1	.191	.146	.703
2-WAY INTERACTIONS	2.577	1	2.577	1.972	.163
REWARD SIT	2.577	1	2.577	1.972	.163
EXPLAINED	3.128	3	1.043	.798	.497
RESIDUAL	173.806	133	1.307		
TOTAL	176.934	136	1.301		

Table 21

ANOVA Table for Attitudinal Item 14 (enjoy working in a group):Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	30.631	2	15.315	9.474	.000
REWARD	4.442	1	4.442	2.748	.100
SIT	25.724	1	25.724	15.912	.000
2-WAY INTERACTIONS	1.174	1	1.174	.726	.396
REWARD SIT	1.174	1	1.174	.726	.396
EXPLAINED	31.805	3	10.602	6.558	.000
RESIDUAL	221.472	137	1.617		
TOTAL	253.277	140	1.809		

Table 22

ANOVA Table for Attitudinal Item 15 (would like to work alone at computer): Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	15.098	2	7.549	3.872	.023
REWARD	.559	1	.559	.287	.593
SIT	14.413	1	14.413	7.392	.007
2-WAY INTERACTIONS	.005	1	.005	.002	.961
REWARD SIT	.005	1	.005	.002	.961
EXPLAINED	15.103	3	5.034	2.582	.056
RESIDUAL	267.110	137	1.950		
TOTAL	282.213	140	2.016		

Table 23

ANOVA Table for Attitudinal Item 16 (learn more when group): Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	19.483	2	9.741	6.518	.002
REWARD	1.020	1	1.020	.682	.410
SIT	18.272	1	18.272	12.226	.001
2-WAY INTERACTIONS	.697	1	.697	.467	.496
REWARD SIT	.697	1	.697	.467	.496
EXPLAINED	20.180	3	6.727	4.501	.005
RESIDUAL	204.756	137	1.495		
TOTAL	224.936	140	1.607		

Table 24

ANOVA Table for Attitudinal Item 17 (would like to use WA again):Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	1.007	2	.503	.421	.657
REWARD	.098	1	.098	.082	.775
SIT	.896	1	.896	.750	.388
2-WAY INTERACTIONS	3.986	1	3.986	3.337	.070
REWARD SIT	3.986	1	3.986	3.337	.070
EXPLAINED	4.993	3	1.664	1.393	.248
RESIDUAL	163.646	137	1.194		
TOTAL	168.638	140	1.205		

Table 25

ANOVA Table for Attitudinal Item 18 (work best by self): Reward by Situation

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	18.881	2	9.440	5.875	.004
REWARD	1.500	1	1.500	.933	.336
SIT	17.590	1	17.590	10.946	.001
2-WAY INTERACTIONS	.219	1	.219	.136	.713
REWARD SIT	.219	1	.219	.136	.713
EXPLAINED	19.100	3	6.367	3.962	.010
RESIDUAL	220.148	137	1.607		
TOTAL	239.248	140	1.709		

DISCUSSION

The discussion is divided into several sections: overview, achievement, attitudinal questionnaire, implications for practitioners, summary, and suggestions for further research. Information from unstructured session observations is used to supplement that derived from analysis of the data and the literature.

Overview

The implementation of the study went very much as planned. The few changes that had to be made were all scheduling changes and did not change the nature of the task nor its execution.

There were no significant achievement differences among the conditions, most students performed well on the multiple choice test and poorly on the sentence completion test. These results may have been influenced by a variety of factors including: treatment length, time spent on different levels of the computer program, the nature of the software and/or the posttreatment achievement tests, and group dynamics.

Students who worked under a cooperative reward structure tended to enjoy the experience more than those who

worked under an individualistic reward structure, though all students rated their computer experience positively. This enjoyment held true in spite of group-mate pressure, in the cooperative reward structure groups, to do well. It may have been that the camaraderie of the situation, the desire of all participants that their groupmates do well, made the experience more pleasant for those in the cooperative condition.

Achievement

There were no significant differences among conditions in pretreatment vocabulary ability. The random assignment of students to conditions was successful in establishing heterogeneous ability level groupings, as supported by the analysis of pretreatment ability levels.

Johnson and Johnson (1985) and Slavin (1985), among others, have stated that students can learn more when they work in groups. Both the computer-assisted learning and the cooperative learning literature (e.g.,Bangert-Drowns, Kulik & Kulik, 1985; Hasselbring, 1986; Johnson, Johnson and Stanne, 1985, 1986; Chalip & Chalip, 1978; Clements & Nastasi, 1988; Johnson, Maruyama, Johnson, Nelson & Skon, 1981) suggest that achievement can be enhanced by the use of cooperative reward structures. Johnson, Johnson and Stanne (1986,1985) examined the relationship between reward

structure and achievement in students using the computer. They reported that students in the cooperative computer-assisted condition achieved higher levels of achievement and enjoyed the task more than did students working under either an individualistic or a competitive reward structure.

The present study includes three hypotheses related to achievement. It was hypothesized that the only difference in achievement would occur between students who used the computer in groups of three under a cooperative reward structure and students who used the computer in groups of three under an individualistic reward structure, the former demonstrating greater achievement. It was hypothesized that reward structure would not affect the achievement of students who worked alone. Finally it was predicted that students involved in cooperative group work would show achievement equal to that of students working alone under either reward structure (cooperative or individualistic). There were no achievement differences among the students in the differing conditions. Neither reward structure (cooperative or individualistic) nor situation (group or individual work) had an effect on the students' posttreatment achievement scores. While these results do not support the notion that cooperative reward structures induce greater achievement they do strengthen the theoretical supposition that group work is as effective as individual work.

Johnson, Johnson, and Stanne (1986,1985) found that cooperative reward structures promoted greater academic achievement than did individualistic reward structures with students working in groups on the computer. There is some doubt as to exactly how much time the students in the study actually spent working on the computer. Perhaps their results only hold true for students who work under conditions of combined computer and seat work. This study examined computer use in a pure state, there was no confounding of this form of learning with any other form, as may have been the case in the Johnson et al. study. Students in the present study worked solely on the computer. There was no form of supplemental seatwork used. No support was found for Johnson, Johnson and Stanne's claim that the use of group work and/or cooperative reward structures would increase academic achievement. It may very well be that cooperatively structured group computer work does not promote greater gains in academic achievement.

Group Work and Reward Structure

The reward conditions were explained to the students at the beginning of the first session. It was evident that the students had little or no experience with the cooperative reward condition but it appeared that most students understood what they had to do to receive a reward, as evidenced by the following exchange: "Mark! You have to

watch! If you don't you won't do well on the test" "I don't care" "If Marc doesn't [get an award] then none of us will!" The studnets didnot complain about the conditions that they had to meet to receive the reward but there was an obvious concern, in the cooperative reward condition, about the fact that either their group-mates, in the groupwork situation, or the others in the computer room, in the individual situation, had to attain the same high level of achievement they themselves had to attain for all to receive a reward.

The students seemed to understand the conditions for receiving a reward, the students working under an individualistic reward structure were working in situation similar to that which they normally operated under but the students working under a cooperative reward structure did not have prior experience to fall back on. Schmuck and Schmuck (1988), as well as Johnson and Johnson (1985), Kagan (1986), and Webb (1982), and others, stress the importance of individual and group skill knowledge in the effective functioning of groups. Webb (1982) suggests that the behavior of students in a group is very important; that there is a positive relationship between giving help and achievement. She also states that effects of receiving help depend on the conditions under which the help is given, the student's role in getting help and the type of help offered. Perhaps if the students working in groups had been given some information on how to work as a group their academic

achievement might have improved.

Treatment Length

There may be several reasons as to why there were no differences on the posttreatment measures among students in the different conditions. One of these factors may have been the length of treatment. Johnson, Johnson, and Stanne (1986,1985) found greater achievement in students who worked in cooperative groups, as compared to individualistic reward groups. In their study students' seatwork was supplemented by computer use for ten forty-five minute sessions. Mevarech, Stern and Levita (1987) had students working in groups two or three times a week for two months, they too found greater academic achievement significant achievement in the cooperative reward structure groups. The students in the present study worked on the computer for two half-hour sessions. Some time in the initial session was spent adjusting and becoming comfortable with the physical setup. The students then had to spend time learning how to use the software. Though the implementation of the studies were not exactly the same perhaps different results would have occurred if the students in this study had had more time to work on the computer.

Software

The software appears to have been successful in teaching the students the meaning of the words, as evidenced by posttest achievement scores, the mean score for the multiple choice posttest was 20.64 out of a possible 25. The software was less successful in teaching the students how to spell the words and use them in a sentence; the mean sentence completion score was 9.32, again out of a possible 25. The reason for the differing results may be that the students spent most of their time using parts of the program which taught to the multiple choice method of testing, a lower level cognitive ability according to Bloom (Gallahue, Werner, and Lueduke, 1975), or it could be that multiple choice tests of this nature are in some way easier than tests which require more of the student than just picking one of several possible answers.

The fourth and most used level of the software was an exciting game. The format of the game was similar to that of the multiple choice posttest, students were given a word and they had to choose the correct definition. The majority of the students spent a very large portion of their time working on this level. Once a group or an individual in the computer room had reached this level the others in the room usually hurried to get to that level as well. Most students went directly to level four in their second session, not bothering to spend much, if any time working in any of the

other levels. It could be, therefore, that the multiple choice test scores were very high because this is the area in which the students had the most practice. A second factor which may have influenced the posttest score differences is that the students had fewer clues as to the correct answer in the sentence completion posttest. Not only did they have to know the correct word to complete the sentence they also had to know how to spell it.

Unstructured Observations - Length of WA Level Usage

Once started there was considerable difference among the groups and individuals as to the length of time it took to complete any one level of the four levels of software. The amount of time spent in each level may have had an effect on the students' ability to learn the information presented in that level, as suggested above in the discussion pertaining to the multiple choice test results.

The different levels of the software had different sound effects. The first level made no sound while the second and third had different musical sounds for correct and incorrect answers. Students quickly came to recognize these sounds and comments were sometimes made when the incorrect answer sound was heard from another computer. Students seemed to become very aware of the fact that others knew when they were making mistakes and sometimes explained out loud why they had made the mistake. At other times

students blamed the computer, "this thing [the computer] cheats! ", or others in their group they had made a mistake. The fourth level was a game and had many different sounds. Some students found that it was possible, in levels two and three, to randomly press a key several times and that computer would eventually respond with the correct answer and move on to the next question. This random method was most often used when someone in the room had reached the fourth, game level of the software and other students were anxious to get to that level themselves. Though there were several students who moved to the fourth level using this technique many of them returned to lower levels when they realized that they could not get high points on the game unless they knew the words and their meanings.

One student complained that his group-mate could read and understand the material on the screen much more quickly than he could. The student was becoming frustrated because his group-mate was in control of the keyboard and was moving ahead at too quick a pace. This student suggested that groups should be made up of students of similar abilities. It was his feeling that he would be more comfortable working with someone who shared his level of comprehension and read at his speed.

The difference in time was also evident between the groups and individuals. Variations in the time spent on the various levels depended on several factors. One factor was

the speed with which the group or individual could select the correct answer. Selection of an answer took various forms; some individuals selected their answer by themselves while others asked for help, either from a specific individual or by stating their question out loud for anyone to answer. Response selection in the groups usually took one of three forms; one person would enter the answer without discussion with other members of the group, the group members would discuss the possible answers and come to an agreement, or the group members would take turns answering questions. The time it took for the various procedures was greatly varied. The group decisions tended to take the longest while individual decision making was often the quickest. Unfortunately there was no mechanism set up to study or measure these differences and relate them to posttest achievement scores.

An other factor which affected the time spent on a level was the level of proficiency the student(s) wanted to attain before moving on to the next level. There was a great deal of variation in this factor. Some students were happy just whizzing through a level and moving on to the next, others worked until they received one hundred percent; there seemed to be as much variation in this as there were groups and individuals working on the computers.

It was interesting to note that many of the cooperative groups made sure that all members were able to correctly

answer the questions before they moved on. If there was a particular student who did not seem to be understanding, others in the group would often encourage him/her to try and answer or quiz them on the correct response. The other group members were concerned that their group-mate should know the words and their meanings. There were a small number of instances where this concern was demonstrated in a rather aggressive and sometimes threatening manner. In these cases the group members seemed to be very concerned that they should receive a reward and not be held back by one person. The concern about receiving a reward may have been the motivation for group helping, but the experiences of the slower or less able student in an supportive group was much more positive than was that of the same student in an aggressive group. There was one group who was very hard on one member who had a great deal of difficulty remembering the words. The other members of the group threatened him saying that he had better pay attention and not be the cause of none of them receiving an award. One of this student's group-mates wrote out the words from memory outside of the computer room and gave them to him to study. The student in question seemed jubilant when he found out that he had passed the required minimum score for receiving the reward but this jubilation may have been relief at not having to endure the wrath of his group-mates.

Attitudinal Questionnaire

It was hypothesized that subjects who worked on the computer in a group would enjoy the experience more than would those who work on the computer alone and that students who worked in a group of three under a cooperative reward structure would enjoy the task more than subjects in any other condition. Neither of these hypotheses were supported by this data. It may be that treatment length had something to do with these findings. Perhaps students did not work together for a sufficient length of time for effects of this sort to become apparent. As discussed above this study was very short in duration when compared with two studies, Johnson, Johnson, and Stanne (1986,1985) and Mevarech, Stern and Levita (1987), which did find effects in these areas.

Reward Structure

It was also hypothesized that students who worked under a cooperative reward structure would enjoy the task more than those who worked under an individualistic reward structure. Researchers, including Johnson, Maruyama, Johnson, Nelson & Skon (1981) and Slavin (1984, 1980), have found that students working within a cooperative reward structure tend to be more motivated and enjoy the task more than do students working under a competitive or individualistic reward structure. This was found to be true

for the students in this study. Those students who worked under a cooperative reward structure reported enjoying the experience more than those who worked under an individualistic reward structure. This greater level of enjoyment may have been due to the fact that all students in the room, or group depending on the situational condition, were working towards a common goal. There was a great deal of sharing and discussion during all of the computer sessions but there tended to be even more among students working in the cooperative reward condition. In the individual situation cooperative reward condition this increased communication took the form of answers being called out, students running back and forth among the computers to help each other out when they were stuck on a particular question, and widespread sharing of information. This type of behavior was also seen in the group situation cooperative reward condition but was focused within the group rather than among all the students in the computer room.

Problems with Unstructured-Observations

One purpose of this study was to examine students' enjoyment of the computer-assisted learning experience. No specific form of observation was used during the sessions. There were a great many things happening at the room at any one time. Students were questioned, via a questionnaire,

about their experience but this information could have been supplemented by structured observations taken during the computer sessions.

The reward condition that the students worked under seemed to influence their behavior during the computer sessions. A brief analysis of notes about student behavior taken during the sessions reveals that groups who were working under a cooperative reward structure tended to spend more time making sure that all members understood the words than did members in groups that worked under an individualistic reward structure. Students who worked alone at the computer tended to announce their scores and percentages out loud, both to others in the room and to the experimenter, than did those who worked in groups. Clearly much information could be gleaned from some form of organised observation of the computer sessions.

Lack of Pretreatment Information

Though the attitudinal questionnaire provided information about the students' feelings about the experience they had just been involved in but there was no pretreatment measure with which to compare that information. It would have been helpful to know the students' opinions about group and individual work before they were placed in these situations. Their beliefs about computer use and the appropriateness of differing reward structures might have

also contributed valuable information when compared with the posttreatment measure.

Unstructured Observations - Reward Condition

All students in the computer room at one time were working under the same conditions but students were aware of the differing conditions as they discussed them outside of the computer room. Some students did not want to work with specific individuals, others stated that they would prefer to work by themselves but overall the students tended to be satisfied with their assigned condition, as evidenced by their responses to the questionnaire.

In spite of a few aggressive occurrences all of the students seemed to enjoy their computer experience. Comments such as "Hey! This is fun!" and "This is so fun! I can't wait to do this again!" were common. The students indicated their enjoyment both in their answers to the questionnaire and by their behavior in the computer room. The students were very happy and excited when they reached the computer room, they were anxious to begin using the computers and the software and several asked, hopefully, whether they would get another opportunity to use the software. Several students stated specifically that they thought that using the computer was a very good way to learn words.

Summary

The implications of these results are mainly twofold. This study provides no support for the notion that students' academic achievement is enhanced by group computer work. When lack of resources or other factors dictate group use it does not seem that a fear of decreased academic advancement is justified. Nor, then should group work be necessarily used, unless there are other desirable effects seen. Though the support and encouragement of the group may aid individuals in their learning process, it could also do them harm if, rather than benevolent encouragement and reassurance, they receive threats and various forms of hostile coercion from their group-mates.

There is a body of research on group computer use (e.g., Guntermann and Tovar, 1987; Baron, Abrami, and Wasserman, 1986; Webb, 1985a) that concludes that group computer use does not result in lower achievement, as opposed to individual computer use. These studies do not address the question of group composition. Anderson (1988), Moorham & Dishon (1983) and Johnson & Johnson (1985) recommend heterogeneous groupings. In this study the relationships within the groups ranged from very supportive and helpful to aggressive and threatening, and from close academic ability to very different abilities. There were instances during this study that seemed to indicate that

social and/or ability heterogeneous grouping might not be the most effective grouping method. Instances occurred where students seemed to treat their group-mates with disdain, dislike, and behavior bordering on cruelty. There were several verbal attacks on individual group members where their personal attractiveness, cleanliness and/or intellectual capabilities were commented upon. It would seem that both social and academic skill factors could play an important role in the effectiveness of the group as a whole and in the experience that an individual has within the group. Though academically it does not seem to be to a student's disadvantage to work in a group, perhaps that is not enough to warrant group use.

Implications for Practitioners

Most schools still do not have enough computers for individual use on any but a very small scale, group computer use is still a necessity in many, if not most, instances. It would seem that it is not enough to randomly assign students to groups and expect them to work well together at the computer. As seen above there are many factors which have an influence upon the computer use experience. Though there seems to be no academic cause for concern about group computer use there may be social and personal ramifications of random assignment to groups. Perhaps some form of inter-

personal skill training would increase the chance that the group experience would be a positive one for students. It would stand to reason that this type of training would not be detrimental to the students involved and as such should be used when ever possible.

Students seemed to enjoy the computer experience more when working under a cooperative reward structure. A more microanalysis of cooperative group functioning might shed light on the nuances of the experience. This knowledge may provide guidance for structuring computer groupwork. The reward structure could be teacher or software imposed.

The software program used was not designed for group use; perhaps there are ways in which this, and other programs, could be modified so as to encourage group work. Having the program fashioned so that students have to share information and take turns might attain this end.

The aim of practitioners is to provide students with an educational experience which is both instructive and enjoyable. Clearly much thought must be given before implementation of a cooperatively structured group computer program.

Suggestions for Further Research

This study was very short in duration and the learning task was not extensive. The total time spent working on a computer was only one hour; it may be that more time spent working on the computer learning the material could affect both the achievement and attitudinal scores. The students had to master a new software program, and learn to spell and use twenty-five new words. Half of the subjects also had to learn how to cope with and work in the group they were assigned to. Possibly an hour is too short a period of time in which to expect students to accomplish all this. Studies involving different amounts of on-task time might reveal differences that the time here was too brief to uncover.

Only one piece of software and thus one learning task was used; perhaps results of a different nature may occur with the use of problem-solving or some form of creative software. Studies involving two or more pieces of software could shed light on this issue.

There may be a very close relationship between the manner in which information is presented and practised in the software and the form in which it can be recalled. If knowledge is to be demonstrated in various forms then the students should have adequate and appropriate practice in these forms. It would seem reasonable that if the students had spent more time on the sentence completion level of the

software their scores in that area would have been higher.

Group composition was not explored. Groups in this study were heterogeneous according to ability and social factors; this too may have affected the outcome of the experiment. This area should be investigated both from the aspect of academic and social compatibility. It stands to reason that the composition of a group could have a great effect upon both the academic achievement of the members and their enjoyment of a task as well as having implications for the development of self-esteem.

The students had little previous experience working in groups or being responsible for helping others learn material. It would be interesting to see what affect training in group relations and interpersonal skills would have on both the academic and social aspects of computer learning.

In closing it should be noted that though new educational applications are being developed everyday, one should not lose sight of the larger context in which all these systems operate. Perhaps the methods being used are changing the very definition of the world the students live in. It may be that both the academic and the attitudinal outcomes were influenced by one or a number of the above factors. Further research into these areas will shed light on these issues.

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Appendix 1

INSTRUCTIONS TO STUDENTS

Single subject individualistic reward condition

Today you are going to use a software program called Word Attack. This program is designed to teach you some new words and give you a chance to practice using those words. Please wait until I tell you to start. There are four levels in this program. You are to start with level one and proceed through each level in order. You can repeat a level before going on to the next and you can return to any previous level but do not jump ahead to later levels. Once you have completed all four levels at least once you can practice the words using any level or levels you wish. Are there any questions? Be sure to read the instructions that are given for each level. When you get to level three you can get help by pressing the h key and then the return key. The program will then give you a list of four words to chose from.

You will use this program for a half an hour today and again for another half an hour later in the week. You are to work at your own computer for the full period. After you have used the computer for the two sessions you will be given a test, in class, to see how well you have learned the words. Each one of you who scores 75% or better on the test

will receive an award of academic excellence and will have your name published in a news letter that I will be giving out to the whole class. Do any of you have any questions? If you have any questions or problems with the program raise your hand and I will come and help you. You can now start using the program.

Single subject cooperative reward structure condition

Today you are going to use a software program called Word Attack. This program is designed to teach you some new words and give you a chance to practice using those words. Please wait until I tell you to start. There are four levels in this program. You are to start with level one and proceed through each level in order. You can repeat a level before going on to the next and you can return to any previous level but do not jump ahead to later levels. Once you have completed all four levels at least once you can practice the words using any level or levels you wish. Are there any questions? Be sure to read the instructions that are given for each level. When you get to level three you can get help by pressing the h key and then the return key. The program will then give you a list of four words to chose from.

You will use this program for a half an hour today and again for another half an hour later in the week. You are to work at your own computer for the full period. After you have used the computer for the two sessions you will be given a test, in class, to see how well you have learned the words. If all of you score 75% or better on the test you will all receive an award of academic excellence and will have your names published in a news letter that I will be giving out to the whole class. As you can see it is

important that all of you learn the words well. Do any of you have any questions? If you have any questions or problems with the program raise your hand and I will come and help you.

Three subject individualistic reward structure condition

Today you are going to use a software program called Word Attack. This program is designed to teach you some new words and give you a chance to practice using those words. Please wait until I tell you to start. There are four levels in this program. You are to start with level one and proceed through each level in order. You can repeat a level before going on to the next and you can return to any previous level but do not jump ahead to later levels. Once you have completed all four levels at least once you can practice the words using any level or levels you wish. Are there any questions? Be sure to read the instructions that are given for each level. When you get to level three you can get help by pressing the h key and then the return key. The program will then give you a list of four words to chose from.

You will use this program for a half an hour today and again for another half an hour later in the week. You are to work with your group at your computer for the full period. After you have used the computer for the two sessions you will be given a test, in class, to see how well you have learned the words. Each one of you who scores 75% or better on the test will receive an award of academic excellence and will have your name published in a news letter that I will be giving out to the whole class. Do any

of you have any questions? If your group has any questions or problems with the program have one of your group members raise his or her hand and I will come and help you. Your group can now start using the program.

Three subject cooperative reward structure condition

Today you are going to use a software program called Word Attack. This program is designed to teach you some new words and give you a chance to practice using those words. Please wait until I tell you to start. There are four levels in this program. You are to start with level one and proceed through each level in order. You can repeat a level before going on to the next and you can return to any previous level but do not jump ahead to later levels. Once you have completed all four levels at least once you can practice the words using any level or levels you wish. Are there any questions? Be sure to read the instructions that are given for each level. When you get to level three you can get help by pressing the h key and then the return key. The program will then give you a list of four words to chose from.

You will use this program for a half an hour today and again for another half an hour later in the week. You are to work together with your group at the computer for the full period. After you have used the computer for the two sessions you will be given a test, in class, to see how well you have learned the words. You will be given a group score for the test. The group score will be the average score of your group. That means I will add up your three scores and divide by three to get the average score or group score. As

you can see it is important that everyone in your group learns the words. If your group score is 75% or better your group will receive an awards of academic excellence and will have your names published in a news letter that I will be giving out to the whole class. Do any of you have any questions? If your group has any questions or problems with the program have one of your group members raise his or her hand and I will come and help you. Your group can now start using the program.

Appendix 2

LETTER OF PERMISSION

Dear Parents,

In the next few weeks researchers from Concordia University will be conducting research in your child's class. The aim of this research is to evaluate the effectiveness of group computer use. The students will be using instructional software to learn new vocabulary. In order for this study to be successful we need all students to participate. Please fill out the permission slip below and return it to the school tomorrow.

This study is being carried out as part of my Masters in Educational Studies and as a project of The Centre for the Study of Classroom Processes. If you have any questions or concerns please do not hesitate to contact me. I can be reached at 453-8691 or 848-2020.

Thank-you

Jenny Schaeff

.....

I **give** permission for my child, _____, to participate in the above mentioned research project.

or

I **do not give** permission for my child, _____, to participate in the above mentioned research project.

signed_____

date_____

Appendix 3

COMPUTER USE QUESTIONNAIRE

Name:_____
Teacher:_____
Date:_____

Please CIRCLE the number which is closest to how you feel about each sentence.

1. I like to work by myself.

1	2	3	4	5
not at all		some		a lot

2. Word Attack was a fun program.

1	2	3	4	5
not at all		some		a lot

3. I would like to work on the computer in a group.

1	2	3	4	5
not at all		some		a lot

4. The level of Word Attack that I liked the best was

level 1 level 2 level 3 level 4

5. I enjoy using the computer.

1	2	3	4	5
not at all		some		a lot

6. I learn more if I work by myself.

1	2	3	4	5
not at all		some		a lot

7. Word Attack made learning the words easy.

1	2	3	4	5
not at all		some		a lot

8. I used the computer: 1) alone; 2) with a group and I think that this is the best way to use a computer to learn new words.

1	2	3	4	5
not at all		some		a lot

9. I enjoy learning more when I have people to work with.

1	2	3	4	5
not at all		some		a lot

10. I would like to learn new words in class rather than by using the computer.

1	2	3	4	5
not at all		some		a lot

11. If I had the choice I would choose to use the computer:

1) alone; 2) with a group

12. I like using a computer to learn new words.

1	2	3	4	5
not at all		some		a lot

13. I had enough time to learn the words.

1	2	3	4	5
not at all		some		a lot

14. I enjoy working in a group.

1	2	3	4	5
not at all		some		a lot

15. I would like to work alone at the computer.

1	2	3	4	5
not at all		some		a lot

16. I learn more when I work in a group.

1	2	3	4	5
not at all		some		a lot

17. I would like to use Word Attack again.

1	2	3	4	5
not at all		some		a lot

18. I work best by myself.

1	2	3	4	5
not at all		some		a lot

Appendix 4

ACHIEVEMENT POSTTESTS

NAME_____
CLASS_____

There are 2 parts to this test. You are to do PART A first and then PART B !!! You can not go back to PART A after you have begun PART B !!! The directions for each part are different. Please be sure that you read the directions carefully before you begin. If you have any questions while you are doing the test raise your hand.

PART A USING THE WORDS YOU LEARNED WITH WORD ATTACK
PLEASE FILL IN THE BLANKS

example: strange
The soccer coach was a bit _____ , he had all his students wear red armbands to each game.

PART B PLEASE CIRCLE THE LETTER OF THE WORD WHICH MATCHES THE DEFINITION GIVEN

example: Baggage

a) luggage
b) clothing
c) unfriendly
d) thick, dense
e) a home

PART A USING THE WORDS YOU LEARNED WITH WORD ATTACK
PLEASE FILL IN THE BLANKS

1) An angry dispute

Peter and his parent got into an _____ about when he should come home from the party.

2) A coffin

The young lady's body was sent home in a _____ .

3) A sweet alcoholic medication

The doctor gave an _____ to the girl to help her cough.

4) A harsh sound

The car had no muffler and created a _____ when it was driven down the street.

5) The outside boundary

The fence marks the _____ of the school grounds.

6) A plan for a dance

The school had no one to do the _____ for the musical.

7) A way of doing something

All the students knew that their teacher had his own strange _____ of giving tests.

8) A raised platform

A _____ was built for the Prime Minister so that all could see him when he delivered his speech.

9) A deficiency in the blood

Her blood tests showed that she had an iron deficiency and was suffering from _____.

10) A softener

His hands were so dry and rough from his work that he had to rub an _____ on them to make them feel better.

11) An eye doctor

The teacher was having trouble seeing so he went to visit his _____.

12) High praise

Jack received a _____ from the principal for his excellent marks.

13) A minor weakness

Jeffery had a _____ for chocolate and he would not say no if anyone offered him a piece.

14) A thin strip of connecting land

We crossed the _____ from the beach to the small point.

15) A group of songs

The group had a whole new _____ to perform at the concert.

16) Long life

Susan's family was famous for their _____, her Grandfather had lived to be 110!

17) A doctrine

The freedom for all _____ of the group was the doctrine that they all lived by.

18) An official who certifies documents

The _____ was called to certify the man's will.

19) An act which justifies a later one

Jennifer felt that since had Geoff done the same thing earlier he had set a _____ and she could do it too.

20) One who receives something

Shawn was the _____ of the 100 dollar prize.

21) Favoritism shown to relatives

Uncle Henry gave the job to his daughter, it was a clear case of _____.

22) A lar heavy-bladed knife

The man used his _____ to cut away the long bushes in the swamp.

23) The animals in a region

The guide said the _____ in the region were beautiful but dangerous.

24) A high ranking church figure

The bishop was a _____ from the neighbouring church.

25) An ornament which hangs on a chain

He wore his father's medals as a _____ around his neck.

IF YOU WANT TO CHECK YOUR ANSWERS FOR PART A
PLEASE DO IT NOW
YOU MAY NOT GO BACK TO THIS SECTION AFTER YOU BEGIN PART B

NAME_____
CLASS_____

PART B **Please circle the letter of the word which matches the definition given**

example: Baggage

a) luggage
b) clothing
c) unfriendly
d) thick, dense
e) a home

---

1) An angry dispute

a) anemia
b) foible
c) pendant
d) altercation
e) longevity

2) A coffin

a) optometrist
b) machete
c) dias
d) prelate
e) bier

3) A sweet alcoholic medication

a) emollient
b) eulogy
c) fauna
d) isthmus
e) foible

4) A plan for a dance

a) repertoire
b) longevity
c) choreography
d) altercation
e) isthmus

5) A raised platform

a) optometrist
b) dias
c) anemia
d) machete
e) longevity

6) A deficiency in the blood

a) emollient
b) optometrist
c) anemia
d) notary
e) choreography

7) A softener

a) tenet
b) elixir
c) nepotism
d) repertoire
e) emollient

8) An eye doctor

a) prelate
b) mode
c) notary
d) tenet
e) optometrist

9) High praise

a) nepotism
b) eulogy
c) repertoire
d) pendant
e) precedent

10) Animals in a specific region

a) fauna
b) foible
c) isthmus
d) elixir
e) machete

11) A minor weakness

a) optometrist
b) pendant
c) precedent
d) prelate
e) foible

12) A thin strip of connecting land

a) dias
b) bier
c) isthmus
d) eulogy
e) tenet

13) Long life

a) foible
b) longevity
c) elixir
d) isthmus
e) nepotism

14) A large heavy-bladed knife

a) mode
b) altercation
c) foible
d) machete
e) prelate

15) An official who certifies documents

a) notary
b) prelate
c) recipient
d) nepotism
e) choreography

16) An ornament which hangs on a chain

a) precedent
b) pendant
c) elixir
d) dias
e) bier

17) A way of doing something

a) dias
b) bier
c) eulogy
d) notary
e) mode

18) An act which justifies a later one

a) longevity
b) isthmus
c) precedent
d) tenet
e) eulogy

19) One who receives something

a) nepotism
b) cacophony
c) emollient
d) fauna
e) recipient

20) A high ranking church figure

a) notary
b) prelate
c) tenet
d) cacophony
e) altercation

21) Favoritism shown to relatives

a) optometrist
b) isthmus
c) pendant
d) nepotism
e) notary

22) A group of songs

a) mode
b) foible
c) cacophony
d) choreography
e) repertoire

23) The outside boundary

a) periphery
b) tenet
c) isthmus
d) recipient
e) pendant

24) A harsh sound

a) cacophony
b) isthmus
c) emollient
d) choreography
e) periphery

25) A doctrine, dogma

a) altercation
b) tenet
c) periphery
d) mode
e) eulogy