1-1-1992

A descriptive study of two small peer-directed mathematics groups in an elementary classroom.

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A DESCRIPTIVE STUDY OF TWO SMALL PEER-DIRECTED MATHEMATICS GROUPS IN AN ELEMENTARY CLASSROOM

A Dissertation Presented

by

GAIL E. LIBERTINI

Submitted to the Graduate School of the
University of Massachusetts in partial fulfillment of the
requirements for the degree of
DOCTOR OF EDUCATION
February 1992

School of Education

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DEDICATION

To my father and mother,

Frank and Josephine Libertini

ACKNOWLEDGMENTS

I would like to express my deep gratitude to Dr. David Day, the chairman of my committee, who I have known and respected since 1983. David has been an unfaltering supporter of my efforts throughout my graduate school years. He always listened carefully to my ideas and used his knowledge and wisdom to help me make the best decisions possible. I thank him not only for his mentorship but for his sincere friendship.

I would also like to thank Dr. Patt Dodds and Dr. Mary Lynn Boscardin for serving on my committee. Both of these women sat with me on many occasions to discuss my ideas from the beginning, when I first became interested in children learning from one another, to the completion of my dissertation. Over these years they read numerous versions of my work and proved to be dedicated to my education. I would further like to acknowledge both their senses of humor - many of our discussions ended on a jovial note!

ABSTRACT

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IN AN ELEMENTARY CLASSROOM

FEBRUARY 1992

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The purpose of this study was to describe the behavior of children engaged in two different Peer Work Group (PWG) tasks and to search for patterns of behavior that relate to learning. The study was exploratory in nature and was designed to investigate the processes children use under different PWG task-structure conditions. Two groups of children in a 1st-2nd grade classroom were studied; each group worked for one week on each task and all interaction was videotaped. Detailed information about requests and responses was recorded onto a checklist. Pretests and posttests were administered for each task to assess gains and to search for relationships among tasks, behaviors, and learning.

Results include identification of eleven task-related behaviors with differences across tasks in level of engagement for the following: Independent Seatwork, Group Discussion, Time Off-Task, Waiting for Peers, Cooperative Problem Solving, Approaching the Teacher, and Requesting Help. Patterns in the data for request-response behaviors

agree with sociolinguistic theory regarding "effective speakers". Significant differences were not found within or between groups and tasks on achievement measures. Implications are drawn regarding the influence of task structure on group process and children's use of requesting behavior for obtaining elaborated responses from peers.

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CHAPTER 1

INTRODUCTION

To prepare children for the future, some educators and researchers are advocating a curriculum that stresses problem-solving, understanding, applications, and the ability to communicate ideas and collaborate with others. The use of peer work groups, including cooperative learning techniques, is a method of instruction suitable for a collaborative problem-solving oriented curriculum (Cohen, 1986; Pepitone, 1980; Slavin, 1983; Taylor, 1989).

Peer work groups (PWGs) is terminology used to define a set of instructional methods in which groups of students work together on academic tasks. PWGs involve a range of activities in various subject matters from simple helping groups to more elaborately formulated cooperative learning methods designed for use as alternative means of organizing classrooms for instruction (Slavin, 1987). Because of these differences, there exist many variations on the structure of the learning tasks. PWG task structures differ by features such as: subject matter, nature of materials, form of final products, reward and incentive systems, roles for individual students, and the degree of collaboration involved. For example, tasks may be designed assuming a high degree of equality (in children's knowledge and skills) or a lesser degree of equality with the assumption that children will take on teacher-learner roles.

The reward and incentive systems used in PWGs has proven to be a controversial issue. Some people have emphasized the nature of the reward as being a prime motivating factor for group participants. Participants may be told that their group will receive a reward or grade based on the work the group accomplishes. Other researchers have not altered the reward structure of the classroom when implementing learning groups. That is, although students are instructed to work in a group and help one another, they are still being judged on an individual basis. Still others value purely intrinsic motivation and therefore use no external reward system. The use of the term "task structure", therefore, should be considered to include one or another type of reward structure.

Researchers have studied PWGs as they affect individual achievement, problem-solving skills, attitudes toward subject matter, interpersonal relationships, self-esteem and a variety of other social outcome measures (Slavin, 1983). Research on social outcome measures has reported largely positive results for cooperative learning when compared directly to competitive and individualistic learning. Wheeler & Ryan (1973) concluded from a review of research that individuals in a cooperative situation compared to those in a competitive situation will "see themselves as promotively interdependent, will like each other, exert influence over each other's behaviors, and help each other achieve their goals" (p. 403). In a review of their own work, Johnson & Johnson (1985) reported positive results on a variety of social outcome measures

including interpersonal attraction in groups heterogeneous by gender, ability, ethnicity, learning disability, and peer status.

The research on PWGs and learning outcomes, however, has produced mixed results. Some researchers reported significant achievement gains and others have reported no significant gains for cooperative learning compared to other learning contexts (Johnson et al., 1981; Smith, Johnson & Johnson, 1981; Salomon & Globerson, 1989).

In attempts to understand the contradictory results regarding the effect of peer work groups and learning outcomes, Webb (1980; 1982b) studied groups of children working on mathematics problem solving PWGs. Her major conclusion was that group interaction was positively related to achievement, that is, that process was related to product. More specifically, students who were experiencing difficulty and then received elaborated explanations from a group member seemed to benefit from this help as individual testing showed. Webb concluded that the behavioral norms that developed in groups were crucial predictors of achievement on the problem solving task. "Learning was maximized in groups that had developed norms encouraging explanations" (Webb, 1980, p.81).

Related to process-product studies are studies that use an input-process-product paradigm. That is, research which looked at input variables such as personality, student ability, group composition, and gender in relation to the behaviors exhibited in groups and individual learning outcomes. Webb (1977, Note 1) found, in a study of different group compositions, an interaction between ability (an input variable)

and type of grouping. Learning in mixed-ability small groups was beneficial for high- and low-ability students but not for medium-ability students (who performed better when working in uniform ability groups). These findings were incorporated into the group composition studies and it was found that different ability grouping was correlated to the development of different group norms. For example, groups of uniform high- and low-ability students discouraged explanations and encouraged speedy solutions. Webb also found that medium-ability students engaged in less group interaction in mixed groups than they did in uniform groups.

Later, Webb (1989) found that giving elaborated explanations to one's peers was positively related to learning. Receiving elaborated explanations was only related positively to learning if the receiver acted upon that information by correcting the errors on paper or by solving the problem verbally. Webb also made clear that there are necessary conditions for learning which must be present in order for a student to benefit from a peer's explanation: specifically, the language must be understood, the explanation must be relevant to the question, it must be timely, the student must have the opportunity to correct the mistake and must also use that opportunity. Thus, sequences of interaction must be looked at when considering group process variables. Further examination of these extended group interactions will help in understanding which characteristics of small peer-directed learning groups lead to their being effective classroom learning strategies. It

is clearly not simply the amount of group interaction but the nature of the interaction that relates to variable learning outcomes.

Sociolinguistic methods are being incorporated into input-process-product research with children in PWGs as shown in Webb's meta-analysis of group process variables (1985). By studying children's discourse, researchers can trace sequences of interactions and characteristics of verbal exchanges and relate these to inputs and outcomes of PWGs. For example, Wilkinson and Calculator (1982a) found that children will receive responses to their requests in PWGs to the degree that their speech reflects elements of the "effective speaker model". Wilkinson & Calculator's (1982a) model of the effective speaker is relevant to children's peer work group interaction. The effective speaker is defined as one who obtains appropriate responses to requests. Characteristics of requests were identified that are used by effective speakers. These methods of discourse analysis were used in the present study to examine children's interaction in PWGs.

A new discussion has been emerging in the literature on peer collaboration regarding contexts. Some researchers are suggesting that various context features may affect children's interactions in peer learning situations (Damon & Phelps, 1989; Hertz-Lazarowitz, 1989; Saunders, 1989; Stodolsky, 1984). Specifically, features of the task structure may have a large influence on the behaviors observed in collaborative groups. Therefore, task structure was examined in this study for possible effects on children's behavior.

Statement of the Problem

To maximize the academic benefits of peer-directed learning for children it is necessary to understand the inputs and processes that relate to learning. If reliable and predictive models for peer work group outcomes are developed, then educators can manipulate contexts to encourage the most beneficial interactions among peers. It is likely that variation of PWGs by task structure will yield differences in the nature of children's individual participation and sequences of interaction (Hertz-Lazarowitz, 1989) which could result in a variety of unique task-specific models, each which may be correlated with student achievement. Of specific interest is variation of task structure within subject matter.

Looking at the same groups of children across tasks will enable us to begin to ascertain if and how difference in task structure affects individual behavior, peer interactions, and learning. This information can help us gain greater understanding of PWGs and may also have implications for choosing among these instructional methods (which may vary by task structure) for particular children and to achieve various academic and social objectives. Methodologies which focus on group processes appear to be the most useful for gaining understanding of the relationships between input and outcome variables.

No researcher has yet looked at group processes across task structures or subject matter with the same students in intact groups. The suggested relationship between task-related interactions and indices

of learning (Saunders, 1989; Webb, 1989) has not been systematically analyzed across task structures in the same study. The possibility exists that those processes that promote learning for students in one task will not promote learning for those students in a different task. Different individual behavior and peer interactions may be manifest under varying task structure conditions, which may result in different (i.e., task-dependent) models that relate process to student learning. Conversely, it may be that regardless of task structure the same intragroup learning processes will be used by students in PWGs.

Purpose

The purpose of this study was to categorize the general behavior and the specific request-response behavior of young children engaged in two different PWG tasks and to search for patterns of behavior that relate to learning as assessed by academic achievement measures. The stability of children's behavior and the nature of behavioral patterns which relate to learning may be affected by variation in the task structure of PWG lessons.

The study was exploratory in nature and was designed to investigate children's behavior in small peer-directed work groups. A microanalytic approach to the study of PWG processes (i.e., detailed analysis of children's behaviors in a continuous manner) was the best way to describe all of the children's behavior and to understand the sequences of interaction which relate to student learning. A working observation

instrument was created for this study based on patterns in the literature and pilot study data and was subject to modification once the coding began to allow for emerging behavior categories.

Research Questions

The research questions were grounded in information from the literature review (especially PWG process studies and sociolinguistic studies) and pilot study data. The questions were exploratory and related to PWG functioning, specifically, general task-related behavior and request-response behaviors.

1. What are the (a) general task-related behaviors and (b) specific request-response behaviors and patterns children engage in during PWG tasks (Worksheets and Word Problems)?

2. How does task structure affect general behaviors and request-response behaviors during PWG activities?

3. Are there differences in children's achievement scores within and between the Worksheets Task and Word Problems Task?

Rationale

No study had investigated group process variables for the same groups of children across task structures. Suggested relationships, such as Webb's Model of Peer Interaction and Learning (Webb, 1989) and the Effective Speaker Model (Wilkinson & Calculator, 1982a), needed to be looked at with new populations and different structures of learning tasks. A small number of participants was necessary in order to do micro-analytic study on individual behaviors and interaction patterns. Results lead to a greater understanding of the effects of task structure on the interactional processes of small peer-directed work groups in primary classrooms. Practical implications are drawn regarding the choice of task structure for PWG activities to meet various academic and social educational objectives.

CHAPTER 2

LITERATURE REVIEW

Various Approaches for Studying PWGs

"Motivational" vs "Developmental" Paradigms

There exists tremendous variety in types of peer work groups (PWGs) that are being implemented by teachers and examined by researchers which may be considered to lie on a spectrum. (Detailed accounts of the various PWG studies in their designs, methodologies and results is given in Table 1). A distinction exists between two dominant paradigms for implementing and studying small PWGs each lying on a different end of the spectrum. A debate exists between "developmental" researchers and "motivational" researchers concerning reasons why peer work groups are likely to promote student achievement and learning (Slavin, 1987; Damon & Phelps, 1989).

The developmental perspective guides research on peer collaboration (Damon & Phelps, 1989). Damon & Phelps argued that peer collaboration provides an atmosphere of mutual support whereby peers can engage in discovery learning. In this way deep insights may be gained and new insights and skills realized. The mastery of skills and concepts is best suited by more didactic forms of peer interaction as in peer tutoring.

The developmental perspective is linked to Piaget's (1926) theory of the "disequilibration of thought" and to Vygotsky's (1962) theory concerning the existence of a "zone of proximal development". Based on Piaget's cognitive developmental theory, children learn more by solving problems in collaboration with peers than by working independently due to the cognitive controversy which occurs leading to the co-construction of knowledge. "Students will learn from one another because in their discussions of the content, cognitive conflict will arise, inadequate reasoning will be exposed, disequilibration will occur, and higher quality understandings will emerge" (Slavin, 1987, p. 1162). Vygotsky put forth the idea that children can achieve a higher level of development with others than they could independently; collaboration among peers promotes more advanced development because peers are likely to function within each other's "zone of proximal development". That is, there exists a potential level of development that can be challenged when working with peers operating at similar levels of reasoning. Similarly, Damon & Phelps believe that working with a peer will increase a child's willingness to take risks in experimenting with ideas which leads to discovery learning (1989). Perret-Clermont concluded that peer interaction enhances logical reasoning through a process of active cognitive reorganization induced by cognitive conflict (1980 in Cazden, 1986).

On the other end of the peer work group spectrum, the motivational perspective (which guides one particular kind of cooperative learning) considers the reward or goal structure of the cooperative learning task

to be critically important. From this perspective incentives are the critical component of cooperative methods for students' learning. Cooperative goal structures are used which create situations in which individual group members can attain their own personal goals only if the group is successful (Slavin, 1983). For example, extrinsic group rewards such as grades, praise in a school newsletter, and/or tangible prizes are often used to motivate students to work together. Proponents of the motivational perspective believe that learning is enhanced in these situations because an interpersonal reward structure develops in which members of the group will give or withhold social reinforcement, such as praise for individual input, thereby increasing individual effort. This perspective appears to be linked both to behavioral and social learning theories because of the emphasis on extrinsic rewards and on the importance of the influence of peers (Hill, 1963). However, the problem of the nature of learning (or learned behavior) once the incentive is gone has essentially not been addressed in the cooperative learning literature.

The research methodologies utilized within the two different paradigms are also quite different. Motivational studies have usually been conducted with children from about the third grade level on in classroom settings (DeVries & Slavin, 1978; Sharan, 1980; Slavin & Karweit, 1981; Ziegler, 1981). The developmental research has typically been done with young children between five and eight years of age often working on novel tasks such as conservation tasks in the Piagetian tradition (Forman, 1981; Forman & Cazden, 1986; Newman, Griffin & Cole,

1986; Tudge & Caruso, 1988). Another way in which they differ is in the group size. Motivational researchers have typically studied groups of about five members, and developmental researchers have usually looked at dyads. And, the two paradigms differ dramatically in study duration. Often the developmental studies were conducted for only one session which was observed continuously (e.g., Tudge & Caruso, 1988). The motivational studies of Slavin and colleagues occurred for as long as twelve weeks and groups were typically observed on a weekly basis (Slavin, 1978; 1980b; Stevens, Madden, Slavin & Farnish, 1987). Another important difference is that motivational researchers used an element of intergroup competition and the developmental researchers did not. The use of competitive tasks would be antithetical to the developmental perspective.

The major contrast between the two perspectives is that the developmental researchers believe that learning comes about because of growth through peer interaction, and the motivational researchers believe it is really due to the individual work of each group member (Slavin, 1987). In other words, the latter view is that the group reward structure encourages children to do more work on their own, leading to higher achievement gains for children working under group reward conditions compared to individual reward conditions. The developmentalists would argue, however, that it is not the individual effort that leads to higher achievement in cooperative groups but the deeper level of thinking involved in peer interaction because the children could not have learned as much on their own (even with

increased individual effort). Therefore, the task structures guided by each perspective are different which in turn may affect group interaction and social and academic outcomes.

Because of the methodological differences between the developmental and motivational research paradigms, the studies are only comparable to a limited degree. A comparison of the two perspectives is important, however, because each brings up issues not addressed by the other. A more complete understanding of PWGs may be gained by inclusion of "process-type" studies into the discussion.

Process Studies

Another dominant paradigm being utilized to study PWGs is guided by a "process" oriented perspective. This research places emphasis on studying group interaction processes. These studies may be considered to lie in the middle of the PWG spectrum but are considered in the literature to fall under the umbrella category of "cooperative learning". This third approach will be referred to as process and will be compared and contrasted with motivational cooperative learning studies. First, an introduction into the main themes of this research paradigm will be presented followed by a discussion of the strengths and weaknesses of specific studies of interactional processes.

Process studies commonly examine students' verbal interactions during small group work as mediators between learning outcomes and student characteristics. Researchers studying group processes look at the relationships between inputs, processes, and outcomes. Motivational

cooperative learning researchers, conversely, typically only look at inputs and outcomes which is evident by their study of the effects of student characteristics and varying reward structures on both academic and social outcome measures (Lindow, et al., 1985).

The process studies have usually not altered the reward structure of the classroom, rather students may simply be put into groups and instructed to work together and use one another as helping resources rather than rely on the teacher (similar to peer collaboration methods). In this regard these studies differ from the cooperative learning methods developed as alternative means to classroom instruction by researchers such as Aronson (1978), Sharan & Sharan (1976), and Slavin (1983, 1990). This process research, however, is included in the cooperative learning literature because of the similar cooperative task structures and similarity of a general guiding line of inquiry: Does peer-directed small group work benefit students academically, emotionally, and/or socially?

The role of process-type studies done by Noreen Webb and others can be considered an intersecting point within the cooperative learning literature (Slavin, 1987). The process research can be viewed as a link between researchers working from a developmental perspective and those working from a motivational perspective because it retains elements of both. Webb's research (1982a; 1982b; 1982c), for example, has typically involved junior high and high school students who work together in cooperative study groups to learn mathematics. Although she has not emphasized varying reward structures in her work, her methods resemble

the motivational type of studies in regard to the classroom setting, subject matter, and the use of academic outcome measures. On the other hand, since her research has been concerned with identifying process variables of peer interaction to discern behaviors related to individuals' cognitive growth, and because her subjects engaged mostly in collaborative problem solving tasks (not task subdivision), her work resembles that of the developmentalists.

Process studies will help us understand and identify those mechanisms by which students learn in groups. To know which task structures, and other inputs, relate to learning without knowing the cognitive and social phenomenon involved would be to not fully understand those learning methods. Slavin (1987) proposed that the general underpinning theory of cooperative learning research could be strengthened by these process studies. One of his major means for attaining this goal, however, has been criticized: Once the interactional and cognitive processes that lead to learning in PWGs are identified then the appropriate use of reward structures can be utilized to increase the occurrence of those phenomena. Damon & Phelps (1989) warned of the mistake of trying to combine ("oversynthesize") the various tasks of peer collaboration, peer tutoring, and cooperative learning. For example, they believe that the rich exchanges of dialogue which occur in peer collaboration tasks would be defeated by combining motivational incentives of the type advocated by Slavin. It seems that the best way to resolve this argument is to combine microanalytical study of group process with comparisons of peer interaction in groups

with diverse reward and task structures. That is, merging intragroup and intergroup research methods. This sort of research had not yet been conducted up to this point. And, Salomon and Globerson (1989) discussed two studies in which children in a team learning situation performed poorly compared to children in an individual learning situation on reading and writing tasks.

Background of Process Research. Since the 1970's many studies have examined the relative academic effectiveness of cooperative small group, individual, and traditional large group learning methods concluding that cooperation is the superior method for learning (Johnson, Maruyama, Johnson, Nelson, & Skon, 1981; Slavin, 1980). Between group comparisons of outcomes are common to the typical cooperative learning paradigm. Process studies, on the other hand, have usually looked within small groups for comparisons and have discovered differential learning outcomes for students of varying learner characteristics (Peterson et al., 1985; Swing & Peterson, 1982; Webb, 1982a; 1982b; 1982c). Some of these studies show that cooperative small group learning is not effective for all students. For example, Webb found that high- and low-ability students benefitted from working in small heterogeneous groups but medium-ability students did not (1982a).

Johnson & Johnson's prolific research on cooperative learning methods included some investigation of what they refer to as "processes which mediate and/or moderate" the effectiveness of cooperative small group work. For example, Johnson et al. (1981) reported that peer

tutoring and peer encouragement were two examples of variables that lend to the superiority of cooperative learning methods over learning methods with individual or competitive goal structures. Although the Johnsons discussed their findings in terms of cooperative group processes they were looking at those processes relative to learning methods with other reward and task structures that did not include peer collaboration (e.g. traditional classroom techniques of individual seatwork). Their work usually compared groups by utilizing frequency count measures. These methods could not be considered a microanalysis of interactional processes within groups. Their work seems to be a combination of the motivational and process methodologies for studying cooperative learning.

Smith, Johnson, & Johnson's (1981) work on controversy among peers in cooperative learning groups may be a link between the developmentalist and the motivationalist methodologies. Their conclusions showed that compared to peer learning groups where controversy is discouraged, groups engaging in controversial discussion performed better academically. Here the link between the two methodologies is perhaps more obvious. Smith and the Johnsons were studying cognitive conflict in relation to learning while using the classroom cooperative learning methods (i.e. reward and task structures) as an alternative means of classroom instruction. It should be noted, however, that, again, they used the group as the unit of analysis not the individual - their work really studied the effects of two different

conditions (not of discrete behaviors of the interaction) on achievement.

Researchers such as Webb (1982a; 1982b) and Peterson & Swing (1985) have been studying group process variables with true microanalysis paradigms. They have analyzed individual behaviors (especially speech) occurring within groups in search of process variables related to learning outcomes for individual group members. The unit of analysis has varied within this research; sometimes the group is used and sometimes the individual. This research has typically not involved the comparison of different reward structures of small group learning methods. It draws on the work of sociolinguistic researchers such as Wilkinson and Cooper who have both studied children's verbal communications in small group learning situations (see for example Wilkinson & Calculator, 1982a; 1982b; and Cooper, Ayers-Lopez, Marquis, 1982).

Receiving elaborated explanations in response to requests for help was a major finding in Webb's research which correlated with individual achievement (see Webb, 1985 for a summary). Her 1989 paper focused specifically on group interaction surrounding students' requests for help (Webb, 1989). She proposed a model of peer interaction based on classroom studies of small groups of students learning mathematics and computer science. The model shows a relationship between peer interaction and learning outcomes at the individual level.

In conclusion, it seems that a way to strengthen the cooperative learning literature would be to focus on interaction processes of group

members. Since there are mixed results relative to students' achievement gains when employing classroom cooperative learning methods, it is important to discern the specific behaviors that lead to individual learning (Johnson & Johnson et al. 1981; Slavin & Karweit, 1981; Webb, 1980; Peterson & Swing, 1985). Drawing from the developmental perspective to study cognitive activity of individuals engaged in peer-directed learning tasks may provide insight into why some PWG task structures seem to increase student achievement and others do not.

Interaction Processes Related to Learning. The following will be a critical analysis of research which involve the study of small group interactional processes that relate to individual student learning. The parameters of the discussion will be narrowed by including only those studies that deal with PWG methods employed as an alternative means to traditional classroom instruction as opposed to novel laboratory experiments. The data presented will illuminate specific behaviors that have been found to relate to individual achievement

There is a considerable body of research on social outcome measures and cooperative learning, although it will not be addressed in detail because the literature is vast and is beyond the scope of the present discussion. There does exist a considerable amount of research which points to the benefits of cooperative peer learning compared to competitive and individualistic learning. Wheeler & Ryan (1973) concluded from a review of research that "individuals in a cooperative

situation compared to those in a competitive situation will see themselves as promotively interdependent (each benefitting the other), will like each other, exert influence over each other's behaviors, and help each other achieve their goals" (p. 403). In a review of their own work, Johnson & Johnson (1985) reported positive results on a variety of social outcome measures including interpersonal attraction in groups heterogeneous by gender, ability, ethnicity, learning disability, and peer status. While few have argued against the benefits on these social measures, there is controversy about whether and under what conditions academic achievement (learning) is increased because of cooperative learning methods .

Studying interaction processes that are correlated with learning appears to be the best way to make sense out of the different findings of the effects of cooperative learning on academic achievement. Johnson & Johnson and their colleagues (e.g., 1979; 1980; 1981; 1983; 1984; 1985;) have done a great deal of work to study the effectiveness of cooperative learning methods on various outcome measures. Many of these studies were field-based in schools and classrooms and some were conducted in laboratory settings. Their work is among the first which looked at the efficacy of cooperative learning methods. A major goal of their research has been to discover the internal processes that "mediate or moderate" relationships between cooperation and 1) productivity, and 2) interpersonal attraction among students (Johnson & Johnson, 1985). They have identified several variables that might illuminate the internal dynamics of cooperative learning groups. Those variables which

can be defined as interactions between individuals in the groups will be discussed below.

The Johnsons examined the quality of learning strategies (cognitive functioning) that students used while working in different learning situations. Higher quality learning strategies were defined as strategies which promote discovery. Two such strategies that they looked for were developing classifications and formulating equations. They found that, compared to other learning situations, those who worked in the cooperative learning mode employed "superior strategies". They concluded that the discussion process, characteristic of cooperative efforts, promotes the use of strategies which lead to discovery learning. Therefore, it can be seen that their work is, at least in part, driven from a developmental perspective.

Between the years of 1979 and 1984 the Johnsons studied controversy in a series of studies. Based on their own research and their colleagues' they claimed that, when managed constructively, controversy will promote curiosity which will lead to higher achievement and retention. Due to the nature of competitive and individualistic learning settings, students do not have the opportunity to experience controversy as do members of cooperative groups (Lyons, 1982). Therefore, cooperative learning was concluded to be superior in providing opportunities for controversy and thus higher achievement (Johnson & Johnson, 1979; Smith et al., 1981).

Cognitive processing was also studied as a possible mediating variable involved in the internal dynamics of cooperative learning

groups. In a meta-analysis oral rehearsal was identified as a necessity for the storage of information into memory (Johnson & Johnson, 1981). The researchers reported that their studies indicated more low-, medium-, and high-level oral rehearsal by students of diverse abilities in cooperative compared to individualistic settings (Lyons, 1982; Roy, 1982). It should be kept in mind that the storage of information into memory does not necessarily indicate advances in more complex forms of learning such as the development of reasoning skills (problem solving, logical thinking). A measure of high-level cognitive functioning may be more effective to assess children's learning.

Active mutual involvement was proposed as another group process variable. Johnson, Johnson, Tiffany, & Zaidman (1983) discovered significantly more active oral interaction of students in cooperative than in individualistic situations. A correlation was found between those students who actively provided information and higher achievement. This correlation is important because it is in agreement with results of other studies to be discussed later which focus on the quality of interaction between group members. The Johnsons' global measures of the amount of active oral interaction and frequency of providing information, however, is of limited usefulness in understanding the complexities of group interaction. Other studies show that not all information exchanged is beneficial. The nature of the oral interactions and substance of information are essential factors for learning. They did not employ the use of audio and/or videotape for

data collection. These tools seem to be essential for capturing and analyzing the complexities of verbal and nonverbal interactions.

The Johnsons also looked at the diverse ability levels among group members. They studied the achievement of high-, medium-, and low-ability students in cooperative groups compared with those in individual and competitive learning situations (Armstrong, et al., 1981; D. Johnson, R. Johnson, Roy, & Zaidman, 1984). They concluded that low- and medium-ability students especially benefit from cooperative learning. This differs from Webb's finding that medium-ability students did not benefit from heterogeneous learning groups (1980; 1982a; 1982b; 1982c). They did not report significant achievement differences for high-ability students in the various learning situations but commented, "At worst it may be argued that high-ability students are not hurt by interacting collaboratively with medium- and low-ability students" (Johnson & Johnson, 1985, p. 118).

Differences in results by ability levels across studies may be due to characteristics of the students and of the tasks used. For example, Armstrong et al. (1981) looked at ability effects from within a population of learning disabled and normal progress elementary school children. Johnson, Johnson, Roy & Zaidman (1984) studied fourth grade children working on social studies tasks. Peterson et al. (1984) looked at children in the second and third grades studying mathematics. Webb (1977; 1980) used students stratified by ability from within an eleventh grade high-ability mathematics class. These four studies point out the

variety within methods which may be a cause of discrepant findings about ability levels and small group learning.

Johnson & Johnson and their colleagues have conducted a vast amount of research on cooperative learning peer work groups. Their results provide evidence that this can be an effective learning mode for the classroom. It should be kept in mind that their work most often measured cooperative against individualized and competitive learning. Therefore, their results are positive relative to those other learning situations. The Johnsons did not examine differential effects within cooperative learning groups among peers. It would be of interest to compare their "mediating" process variables for possible differential effects among individual students in the same cooperative learning group. Hertz-Lazarowitz (1985) pointed out that some variables are more characteristic of specific learning situations and thus the comparison of the different methods (cooperative, competitive, & individualistic) may be problematic. Stodolsky's (1984) work on peer work groups is relevant here also. She asserted that the internal dynamics of instructional settings are partly shaped by the instructional form itself. For example, in a group or team situation individual behaviors can affect group functioning which may affect achievement. Salomon & Globerson (1989) suggested that there are debilitating group effects that interfere with learning in PWGs. For example, the "sucker effect" can occur when a hard-working group member perceives that she is being taken advantage of and may then expend less mental effort to avoid it. This is a debilitating group effect because team members lose motivation

and the team operates below the level it could have (1989). It would be most interesting to study such group effects between varying PWG conditions.

In their summary the Johnsons (1985) claimed that it is evident that cooperative learning can provide appropriate instructional experiences for diverse students who work together. Other studies (Peterson & Janicki, 1979; Webb, 1980; 1982a), however, showed that medium-ability students in mixed ability groups participated very little in cooperative groups and performed poorly on post-tests. Additionally, Swing and Peterson (1984) presented evidence to suggest that small group learning is <u>not</u> effective for all students since there exist differential benefits for low-, medium-, and high-ability students in this learning mode. Details about this phenomenon will be presented later.

Also perplexing is the fact that the Johnsons did not report any significant findings of benefits for high-ability students in cooperative learning situations compared to other learning settings. Webb (1982a; 1982b; 1982c) showed that explaining behaviors were positively related to achievement and that high-ability students were often the students who provided the explanations. Also, studies dealing with peer-tutoring indicate that both the tutor and tutee can benefit from the tutoring process (Feldman, Devin-Sheehan & Allen, 1976). In mixed-ability cooperative groups often the high-ability students take on the role of tutor. Therefore it is surprising that the Johnsons simply

concluded that at worst high-ability students are "not hurt" in mixed-ability collaborative learning situations. Perhaps the high-ability students in Johnson & Johnson's groups did not engage in those behaviors which other researchers found to benefit learning. It is possible that the nature of the task was instrumental in affecting the types of behaviors and roles which students engaged in. Spontaneous tutoring where one student explains a concept or a procedure to another may not have occurred because of the content or structure of the tasks.

In their discussion of active mutual involvement in learning, the Johnsons did report that providing task-related information was significantly correlated with achievement in the cooperative condition, but they did not provide details about which students engaged in these behaviors. It is possible that learning was maximized by the students who received rather than provided the information. And, the nature of the information needs to be defined. For example, 'task-related information' could be either procedural or content related with different effects found between them as regards student achievement. Therefore, detailed information about the interactional group processes would be more helpful than a report of findings between instructional settings. It is possible that some combinations of small group variables (ability, ethnicity, age, type of task) would facilitate more of the desirable peer work group behaviors for all students involved than would other combinations.

The work of Johnson & Johnson and their colleagues therefore points to the necessity of looking even more closely at group process

variables. Since various researchers have come to different conclusions about the experiences of high-ability and medium-ability students, for example, one would want to determine which behaviors students engaged in which led to achievement gains. Research which looked at the qualitative difference between various students' behaviors has illuminated probable reasons for differential learning outcomes. This logically leads to a discussion of research which studied in detail the behaviors of group members interacting in a cooperative learning mode.

Microanalytical Study of Group Interactions. It seems that the best way to study PWG learning is to conduct microanalyses of students' behavior to make sense out of data that show individual differences on outcome measures. Some researchers have been doing analyses of group interaction in search of behaviors related to achievement. The diverse results have contributed to a mixed picture of the impact of student interaction on individual achievement. A reason for the mixed picture may be the generality of the measures of student interaction. "Most studies have not used specific measures of student interaction that reflect the amount of elaboration contained in students' interactions with one another ... and the studies have typically reflected isolated behaviors rather than sequences of interaction among students" (Webb, 1985, p147). For example, Johnson & Johnson and their colleagues did not employ the use of audiotape or videotape in their data collection procedures which would have facilitated analysis of group interactions. On the other hand, Wilkinson & Calculator (1982a; 1982b), with the use

of verbal transcripts made from audiotape, discovered that request-response sequences account for about one-half of students' interactional exchanges in peer-led instructional groups. The following discussion will focus only on those studies which include intensive analysis of the quality and sequences of interactions in group learning situations.

Webb (1977; 1980) studied high school students engaged in mathematics problem solving tasks in cooperative learning groups. Her major conclusion was that group interaction was positively related to achievement. That is, that process was related to product. More specifically, students who were experiencing difficulty and then received elaborated explanations from a peer seemed to benefit from this help. The nature of the task and method of assessing achievement were especially suited to correlational analyses of specific group interactions and particular learning outcomes. Students worked together for one session to learn a mathematical model about scientific notation. The achievement test assessed precisely their understanding of the model. In this way, direct correlations could be drawn between a student's specific question during group work, the response received, and his/her learning. Webb concluded that the behavioral norms that developed in groups were crucial predictors of achievement on the problem solving task: "Learning was maximized in groups that had developed norms encouraging explanations" (Webb, 1980, p 81).

In a similar study of eighth and ninth grade students' small group mathematics work Webb & Kenderski (1985) found supporting evidence for the importance of the interaction processes to each student's learning.

Specifically, they found that giving and receiving explanations were positively related to achievement in high-achieving classes. This study broadens the generalizability of Webb's earlier work (1977; 1980) because it used both high- and low-achieving classes with two math units different in content. However, differences were found between the high- and low-achieving classes. For example, receiving explanations in response to a plea for an explanation did not relate to achievement in the low-achieving classes as it did in the high-achieving classes. And, giving and receiving information were positively related to achievement in low-achieving classes but neither were significant in the high-achieving classes. These differences may have been a result of differing group norms between the two classes. Students in the low-achieving classes rarely asked for explanations; the authors suggested that the near-zero correlations could have been a result of a restricted range for this behavior. If group norms developed encouraging explanations and requests, then it is probable that these would be related to achievement. The differences in interaction patterns between the two groups may have been due to either the different nature of the task or the different populations, or both.

Peterson and Swing (1985) studied second and third grade students working in small groups to assess students' cognitions relative to achievement. They used a stimulated recall technique to examine students' conceptions of explanations which had occurred in their small groups - in this sense they were actually studying the students' "metacognitions". They analyzed data to assess: (1) the children's

actual behaviors (group process) in relation to achievement, and (2) students' conceptions of explanations in relation to their behavior in the group and to achievement. They found that both giving and receiving specific content-related help on the mathematics tasks were significantly positively related to achievement. This supports Webb's (1982c) and Peterson et al.'s (1981) earlier studies which found a significant positive relationship between giving and receiving explanations and achievement. Peterson & Swing's findings also support earlier studies because they found no significant positive relationship between receiving a terminal response (a simple answer to a question with no accompanying explanation) and achievement. This study also lent to the generalizability across age groups because the subjects were younger in age than the subjects in earlier process research.

Peterson and Swing's investigation of students' conceptions of what constituted a good explanation yielded interesting results with obvious implications. They found that students who responded that the best way to explain to a peer was to provide specific content-related information were more likely to achieve on the seatwork than students who did not respond this way. A compelling result was that actually giving a specific content-related explanation was significantly positively related to students' conceptions that including specific information makes an explanation better. The authors point out that students' conceptions of the adequacy of their peers' explanations may serve as an indication of their own ability to formulate an appropriate explanation. It seems obvious that a prerequisite for using effective explaining

behavior is that the children have the ability to formulate a relevant, content-related explanation. It should be noted that this study is unique and that more evidence obtained through student interviews is needed to make generalizations.

Webb (1989) reported results of a meta-analysis of studies with results regarding the processes that relate to achievement in peer work groups. She concluded that giving elaborated explanations to one's peers was positively related to learning. Receiving elaborated explanations was only related positively to learning if the receiver acted upon that information by correcting the errors on paper or solving the problem verbally. She also proposed a list of several conditions for learning necessary for a student to benefit from a peer's explanation, specifically: the language must be understood, the explanation must be relevant to the question, it must be timely, the student must have the opportunity to correct the mistake and the student must use that opportunity. Therefore, Webb's meta-analysis extends the research on group interaction processes by examining the behaviors of the students beyond the acts of giving and/or receiving a content-related elaborated explanation. This work makes it clear that group processes which benefit student learning are complex. The sequence of the interactions is critical. Students' behaviors may be contingent upon group members' behaviors and all of these behaviors may in turn be affected by various contextual factors. And, the studies included in the meta-analysis varied by age group, subject matter and duration indicating generalizability across these variables.

Input-Process-Product Research

Related to the process-product research are studies which used an input-process-product paradigm. The following discussion will be concerned mainly with student ability in relation to group process and learning outcomes. Webb (1980, 1982a, 1982b) found, in studies of different group compositions, an interaction between ability and type of grouping. Being members of mixed-ability small groups was beneficial for high- and low-ability students, but not for medium-ability students. She incorporated this phenomenon into the study of group process and found that different ability grouping was related to the development of different group norms. For example, uniform groups of high- and low-ability students discouraged explanations and encouraged speedy solutions for the group. She also found that medium-ability students engaged in less group interaction in mixed groups than they did in uniform groups and they gave more elaborate explanations in response to peers' questions when in groups homogeneous by ability. So, the group process variables that had been found to correlate with achievement (e.g. receiving explanations) were found to in turn be influenced by the input variable of type of ability grouping. Webb concluded that peer interaction is affected by "a complex combination of group composition and student ability" so that the composition of the group and the ability of individual members cannot be considered separately.

Other researchers have also studied the relationship of student ability and small group interaction to student achievement (Peterson & Janicki, 1979; Peterson, Janicki & Swing, 1981). Swing & Peterson

(1982) studied fifth grade students involved in mathematics tasks. Correlations were drawn between specific interaction behaviors and achievement. Students had been arranged in mixed-ability groups and differential achievement outcomes resulted. Specifically, task-related interactions in small groups benefitted achievement and retention of high- and low-ability students but not of medium-ability students. This study supports Webb's discovery that medium-ability students in mixed-ability groups did not benefit academically from the peer work group interactions.

Webb & Cullian (1983) studied group interactions over time. Junior high school students were observed while engaged in mathematics learning tasks in small peer work groups. The stability over time of relationships among students and group characteristics, group interaction, and achievement was examined. They found that group interaction "tended to be stable over time" (a three month interim between observations), both in frequency and in students' relative levels of participation. This study also supports the research which found type of ability grouping to be a critical input variable as regards group process because group ability composition was found to be the best predictor of interaction. The major difference found between groups of different ability compositions was that asking questions and receiving no answer occurred more frequently in uniform-ability groups than in mixed-ability groups. Since receiving no answer in response to a question has been found to be negatively related to achievement, these results seem to have implications for the efficacy of homogeneous work

groups. It would appear that a discrepancy exists between these results and Webb's (1982a; 1982b) because she had found that medium-ability students interacted more and gave more explanations in homogeneous groups than in heterogeneous groups. In agreement with Webb & Cullian's (1983) findings, however, Webb found that high-ability students and low-ability students actually interacted less when they were placed in peer work groups which were homogeneous by ability compared to groups which were heterogeneous by ability. Differences between these studies regarding student grouping should be pointed out. Webb & Cullian's heterogeneous groups really were comprised of low- and medium-ability students or medium- and high-ability students; Webb's heterogeneous groups were comprised of low-, medium-, and high-ability students. And, Webb's (1979) findings may be questionable since her different ability groups were actually comprised of students who were all from the same high-ability class, this work does point out the complexity of the ability by treatment interaction effects.

Lindow, Wilkinson & Peterson (1985) studied ability as an input variable in relation to small group interaction and achievement with younger students. They studied "dissension episodes" (verbal disagreements) that occurred among second and third grade students who worked in small groups on a two-week mathematics unit on time and money. Individual ability was related to four process variables of dissension episodes: initiation, participation, demonstrations, and prevailing answers. Preserving the group as the unit of analysis, intragroup analyses were used to assess individual students' behaviors. Their

results showed that higher ability students had significantly more prevailing answers and provided more demonstrations than the other students. Prevailing answer was then found to be positively related to achievement. An interesting finding that seems to contradict earlier research on explaining behaviors is that an expected positive relationship between providing demonstrations and achievement did not occur. It was pointed out, however, that demonstrations within dissension episodes were simply used to prove the correctness or incorrectness of various positions held by individual children. These demonstrations may or may not have included explanations so these findings do not actually refute other research results. Another unexpected result was that providing higher order explanations was unrelated to achievement. However, the authors provide plausible reasons why this result, too, does not really contradict earlier research on explanations. For example, the time and money curricula used did not provide many opportunities for the children to give elaborated explanations because of the worksheet format and daily time constraints. Another factor may be that in this study the highest order demonstration category defined was actually most like Swing & Peterson's (1982) definition of the lowest order explanation category which suggested the least amount of cognitive processing relative to the other levels of explanatory behavior. Critical discrepancies among the literature such as this limit comparisons and generalizability.

Sociolinguistic Studies

Analyzing children's speech has become a popular method of research about peer work groups. A series of sociolinguistic studies by Wilkinson and her colleagues (Wilkinson, Lindow & Chiang, 1985; Wilkinson & Spinelli, 1983; Wilkinson & Calculator 1982a; 1982b) investigated young children's use of language in light of a model of the "effective speaker." The effective speaker was defined as someone who uses knowledge of language forms, functions, and contexts to achieve goals in interaction, such as obtaining materials from others, and securing informative responses to their requests for information (Wilkinson & Calculator, 1982a, p85). They specifically studied first-grade students' use of language to request and obtain information and action in peer-directed reading groups. They concluded that whether a request received an appropriate response depended on characteristics of the request. Specifically, children tended to obtain appropriate responses if their requests were for information rather than action; if they were of a direct form; and if they were made to a designated listener. It was also found that there were individual differences among students on the measure of the effective speaker.

This work has implications for the success of peer-directed learning groups in the early elementary grades. It suggests that young children are capable to varying degrees of engaging in teaching and learning roles with peers (see Allen, 1976). When children enter school the functional aspects of communicative competencies are not fully developed but still many are capable of requesting and obtaining

information. Children who are able to obtain appropriate responses to their requests for information will be more likely to benefit from a peer learning contexts (Webb, 1989). Increased understanding of how peers' verbal interaction relates to learning will benefit the use of peer work groups. It is possible that those children who lack the skills of an effective speaker can be helped to learn ways of making requests that will receive appropriate response.

This body of research provides evidence that young children have already begun to develop and utilize competencies for effective social communication. Preschool children and certainly children by age six or seven can use verbal communication and accommodate for different listener needs. This research lends strong support for the efficacy of using small cooperative learning groups in the early elementary grades. The next section of this paper will look specifically at three approaches of studying such learning methods.

Context as Input for Studying PWGs

A new discussion has been emerging in the literature on peer collaboration regarding contexts. Some researchers are suggesting that various context features may affect children's interactions in peer learning situations (Damon & Phelps, 1989; Hertz-Lazarowitz, 1989; Saunders, 1989; Stodolsky, 1984). Specifically, features of the task structure may have a large influence on the behaviors observed in collaborative groups. As Damon & Phelps suggest, peer engagements can

Small group learning methods are so varied that some tasks may be considered high in mutuality (common purpose, planning, joint problem solving) and others relatively low in mutuality (task subdivision, individual testing, competition between groups) (Slavin, 1983; 1990). These differences in task design may reflect philosophical differences about learning (Noddings, 1989). Damon and Phelps argue that tasks that are high in equality and mutuality may benefit children by encouraging their engagement in reasoning, problem solving and the social exchange of ideas.

Saunders (1989) discussed collaborative writing tasks and peer interaction in terms of the tasks' interactive structures. This work appears to agree with Damon & Phelps' argument presented above. That is, children working in peer groups may experience varying degrees of cooperation depending on the task's interactive structure. For example, some interactive structures require students to engage in many stages of a task including planning, sharing ideas and making decisions, while others may simply require students to pool individual resources at the end of a task for a final product. And, Hertz-Lazarowitz (1989) proposed a new approach to studying cooperation and helping in the classroom based on the classroom contextual model (Hertz-Lazarowitz, Sharan, & Hare, 1981). This model includes six dimensions of classroom phenomena to be considered simultaneously including: classroom organization; structure of the learning task; teacher's communication; instructional style; and student academic and social behaviors. It is therefore evident that task structure should be considered one important

component of peer work groups and a critical input variable for research purposes. In sum, the work described above suggests that data needs to be collected on children's behavior in small groups under different task conditions.

Summary

In conclusion, it seems that the best way to fully understand and be able to make decisions about designing and implementing PWGs to benefit students is to study interaction processes. Research that details individual behaviors and sequences of behaviors and relates these to learning is relatively new. More research is thus justified in order to support this emerging theory. A merger of input-process-product and sociolinguistic methodologies has shown utility in providing some data toward this end. In order to corroborate the relationships found among variables, however, investigators must adhere to precise definitions of categories of verbal (and nonverbal) interaction. Webb's method of categorizing types of requests and responses using fairly general terms may help to provide common terminology and structure to the literature. Even so, one must be careful of using definitions of behaviors that are both too broad and too narrow. It is possible that definitions of explanatory behavior may have to vary because of the capabilities of the children involved - due to differences in developmental level, for example.

It is possible that specific types of requests made in PWGs may result in specific types of responses. Research has not looked with similar detail at the characteristics of the requests and the characteristics of the responses for the same groups of students. Incorporating Wilkinson and Calculator's Effective Speaker Model with Webb's Model of Peer Interaction and Learning Outcomes may provide a way to investigate both ends of request-response sequences with similar detail in the same study.

In order to study interaction processes thoroughly the tasks should allow for the possibility of a wide range of behaviors, including the opportunity for children to engage in high levels of cognitive functioning, and especially in observable behaviors such as providing, receiving, and acting upon elaborated explanations (or demonstrations). Task structure should be considered an important component of PWGs and a critical input variable for research purposes. Generalizability across studies will be affected to the degree that the task structures are comparable. Careful consideration should be given to choice of instructional content, materials, and guidelines for student interaction when structuring PWG tasks. Further, student motivation and choice between the use of internal or external incentives (i.e., reward systems) must be considered as part of the task structure. The debate between developmental and motivational researchers concerning the effects of external rewards on learning can only be resolved with empirical studies of children's interaction behavior and cognitive functioning across tasks varying by interaction and incentive structures

(Slavin, 1987; Noddings, 1989; Saunders, 1989). No researcher has yet investigated the interactions of the same groups of children across task structure or subject matter. It is possible that individual children will exhibit different behaviors (even with the same peers in their group) while under different task conditions. Furthermore, since relationships have been found between individual students' behavior in groups and academic achievement, research on PWGs should search for relationships between varying task structures and learning.

Finally, the peer work group literature has varied greatly in regard to input variables such as group size and ability in group composition. Moreover, when measures of ability were used they varied in choice of assessment tool as did post-test achievement measures. These factors confound the current data base on peer work groups, but, in contrast, reliable relationships between individual differences in group interaction and outcomes do seem to exist across studies. These factors should be considered as input variables when searching for relationships between inputs, processes and outcomes of PWGs.

CHAPTER 3

METHODOLOGY

Overview

In this study children's behavior was examined as they worked on two mathematics tasks requiring different degrees of collaboration due to the tasks' interactive structures. Two groups of children in a 1st-2nd grade classroom were studied, each group worked for one week on each task. Data were collected as the children worked four days a week for two weeks on the tasks in a familiar resource room adjacent to their own classroom. Group 1 worked on the Worksheets Task the first week and the Word Problems Task the second week; Group 2 worked on the tasks in the reverse order. The groups were videotaped for the duration of their groupwork each day. The average time per day spent working in groups was near equal by task. This enabled meaningful comparisons to be made about level of engagement in various behaviors by task. The amount of time spent working in small groups, excluding introduction and conclusion, averaged 17 minutes. Data was coded from videotapes onto an observation instrument which was designed for this study and based on pilot study observations. Details about requests and responses were coded on a checklist that was based largely on the work of Webb (1989) and Wilkinson & Calculator (1982a; 1982b). First, general task-related behaviors were coded as they occurred. Second, a more detailed analysis

of the characteristics of each request and response was recorded. Achievement data was compared among children and across the two task structures. Data was analyzed specifically for patterns of request-response behavior and generally to compare group process and level of cognitive elaboration across the two task structures. Relationships were examined between process data and achievement measures.

Research Questions

The research questions were grounded in information from the literature review (especially PWG process studies and sociolinguistic studies) and pilot study data. The questions are exploratory and limited to the specific aspect of PWG functioning, specifically, request-response behaviors.

1. What are the (a) general task-related behaviors and (b) specific request-response behaviors and patterns children engage in during PWG tasks (Worksheets and Word Problems Tasks)?

2. How does task structure affect general behaviors and request-response behaviors during PWG activities?

3. Are there differences in children's achievement scores within and and between the Worksheets Task and Word Problems Task?

Procedures

See Flowchart of Research Activities, APPENDIX A.

Definition of Terms

At this time three major categories of behavior will be briefly defined. See APPENDIX B for a complete list of definitions pertaining to the observation instrument.

Requests refer to all solicitations for information made by students and varied in form and content.

Responses refer to all replies made by students to a peer's request for information; these also varied by form and content.

Patterns of Requests and Responses were each identified by a request which indicated the initiation of a pattern and the subsequent behaviors whch related to that request. A pattern was terminated by one of a variety of responses (including "no response"). Examples of some possible patterns include:

a) In the process of making a request for information, a child is interrupted by another child whose action overpowers the first child's request.

b) A child makes a direct request for help, she receives a timely yet unsatisfactory response.

c) A child who did not receive a satisfactory response to a request makes a revised request and receives an appropriate response.

d) A child makes a request but is ignored by her peers.

e) A child receives and then rejects unsolicited help from a peer.

Participant Selection

Four boys and four girls were selected from a combined 1st-2nd grade classroom. Students were chosen based on developmental assessment records, work samples and teacher evaluation. Due to the effects of ability grouping on student interaction and achievement (Peterson, Janicki, & Swing, 1981; Webb, 1982), a decision was made to use groups of children with similar mathematical ability. All of the children were among the top third of their class in mathematical progress. Children were randomly assigned to groups stratified by gender. One boy dropped out on the first day of taping, leaving one group of four subjects and one group of three.

Consent letters were sent home and written permission from parents was obtained for children to participate in the study (see APPENDIX D). These letters explained the topic of the research and the intervention and data collection methods. Anonymity of the children was assured and terms of withdrawal from the study were explained.

Learning Tasks

The differences between the tasks were due to the mathematical content, materials, procedural instructions and nature of the final products. The tasks were similar in that children could receive stickers as a group if they functioned in a cooperative manner (group reward with no competition between groups).

Worksheets Task. This task was high in individual accountability with individual products required each day in the form of fractions and multiplication worksheets. Children were given individual folders to keep their work in. Their work was corrected daily and the subsequent day they were to correct their mistakes and continue on with the worksheets. Each child could proceed at his/her own pace. This was designed to be a helping-type cooperative group. Procedural instructions encouraged children to cooperate by using each other as helping resources and by checking each other's work for accuracy. The group was to be responsible for making sure each student completed a portion of his/her work and that each student understood the material. At the end of each session, with the guidance of the researcher, the group engaged in self-evaluation to assess their degree of cooperation. Due to the nature of the materials, individual final products and instructions which simply encouraged cooperation and helping, this task may be considered relatively low in degree of mutuality (Saunders, 1989).

Word Problems Task. This task was low in individual accountability with a group product required daily in the form of answers to a set of word problems involving logical thinking and addition and subtraction with carrying and borrowing. Children were instructed to cooperate on each word problem by sharing the word problem cards and/or by taking turns in reading them aloud, helping each other to understand the concept in each problem, agreeing on the method used to solve the problem, and reaching group concensus about the final answer to each problem before moving on to the next. This task also had a component of individual accountability; the children were each given blank paper and pencils and were required to work the arithmetic for each word problem. At the end of each session the group engaged in guided self-evaluation about their degree of cooperation. Due to the nature of materials, group products, and instructions for interaction, this task may be considered relatively high in degree of mutuality and equality (Saunders, 1989).

Preparing Children for PWGs

I worked with the students in their classroom for one month prior to the data collection to familiarize them with myself and to train them for functioning in cooperative small groups. The focus for this training period was to encourage the children to use each other as helping resources rather than the teacher, to cooperate on many aspects of a task, and to take responsibility as a group for the work accomplished.

To familiarize the children with peer work groups I met with the children and held discussions about helping each other with their mathematics. I elicited from them lists of effective and non-effective ways of giving assistance. The children generated (with my facilitation) rules for taking turns, getting a peer's attention, checking each other's work, reaching group consensus, etc. I recorded lists that resulted from these meetings and kept them in the classroom for our reference.

I also implemented role-playing episodes about peers helping each other and let the group critique the role-playing regarding the productiveness of each episode. After the role-playing, the children were put in small groups, different in composition and size from the ones they would be in for the research, to do their math work. They were instructed to help each other with their work, much in the way that they would be doing for the study. The amount of cooperation necessary for the completion of each practice task varied also to prepare them for the different tasks ahead. Each day after their group work we briefly met to assess the groups' functioning. Each small groups did a self-evaluation in the form of a checklist concerning their degree of cooperation.

Instrument

The observation instrument (see APPENDIX C) was developed specifically for this study and is based largely on the work of Webb (1989) and Wilkinson & Calculator (1982a; 1982b). Information gained from a pilot study in the fall of 1989 led to the specific design of the instrument and to additional categories of behavior not addressed by the aforementioned researchers. The instrument was used to code two levels of behavior. First, general task-related behaviors were coded as they occurred including request-response behaviors. This category of behavior was developed by the author through repeated viewings of the pilot study videotapes. Second, a more detailed description of the characteristics of each request and response was recorded. These specific request-response categories were adapted from a variety of research studies (Garvey, 1975; Labov & Fanshell, 1977; Webb, 1989; Wilkinson & Calculator, 1982a). This type of instrument was chosen because it allows for coding categories of behaviors, duration of behaviors, and simultaneous behaviors across children. Prior to coding the data, the author conducted a reliability check especially for consistency in detecting and labeling relevant behaviors. Throughout the coding intrarater reliability checking was done ensuring at least 90% agreement.

Data Collection

Individual achievement was assessed by task-related pretests given prior to the onset of the study and by posttests given at the end of

each week relative to the task content. Test materials were devised upon consultation with the teacher after fractions had been introduced to the children in the weeks prior to the study.

Each group of children worked independently in a resource classroom where the data gathering took place during their regular mathematics instruction period. The children were familiar with this room since it was near their own regular classroom and was often used for special projects and tutoring. Group 1 worked for the first 30 minutes after which Group 2 came in and worked for the second 30 minutes. Each group was audio and videotaped throughout the introduction of each day's lesson and the entire time that the groups were meeting. One camera and one audiotape recorder and omni-directional microphone was used. The camera was set up on a tripod focused on the PWG table so that each group member could be viewed in one field. The camera required minimal manipulation thereafter. The microphone was set in the middle of the PWG table and the audiotape recorder was placed apart from it in order to eliminate audio feedback. Using this style of continuous observation, a record of virtually everything that occurred in the PWG setting was made.

Data Analysis

Observations were made at two levels for each child from the video and audio tapes (see observation instruments, APPENDIX C). First, request-response behaviors (prescribed from analysis of pilot study data and from review of the literature) were coded as they occurred. New

categories of related behaviors were added, some categories were eliminated and some were re-defined. Second, a more detailed analysis of the characteristics of each request and response was analyzed.

Input variables included student pretest scores, teacher's assessment of each child's overall mathematical progress prior to the study, and task-structure. Process variables included a variety of individual and interaction behaviors and specific categories of verbal and nonverbal request-response behaviors (listed in Appendix B). Outcome variables included individual achievement scores. The data was analyzed for patterns of request-response behaviors and for correlations between input (task structure), process and outcome variables. Specifically, each research question was analyzed using the following methods.

Question #1 was designed to describe children's behaviors in the PWGs. Data has been organized and is presented in lists and matrices throughout Chapter IV. First, lists containing all observed general task-related behaviors is presented. Second, matrices are used to present patterns of request-response behaviors. An example of a request-response pattern matrix contains request categories atop vertical columns and response categories down horizontal rows; frequency counts entered in appropriate cells will allow the reader to see frequently occuring patterns. Other descriptive statistics are used to illustrate the data in the form of percentages. For example, analyses of the proportion of a specific request category to all other requests categories are presented.

The purpose of Question #2 was to investigate the effect of task structure on general task-related behaviors and request-response behaviors and patterns during PWGs. The data for the two different groups of children were pooled within tasks and comparisons were made between the Worksheets Task and the Word Problems Task. Statistical t-tests for paired means (two means obtained for each child) were performed on the data for general behavior categories and significant differences between tasks are presented. Matrices with frequency counts and percentages are presented to compare specific request and response categories across tasks.

Question #3 was designed to search for relationships between group processes and achievement, and relationships of achievement by task structure. This was done by searching for differences among children and differences between tasks structutres. Statistical t-tests of the difference between correlated means (two means obtained from the same subjects) were used to compare achievement gains among children within tasks and achievement gains between the tasks. The t-test was chosen over the Analysis of Variance (ANOVA) because the ANOVA is an omnibus test and would show differences but would not illustrate where the differences lie. Post hoc ANOVAS would need to be performed to discern where the differences lie. The individual t-tests, however, report significant differences and illustrate where the differences lie all in one test.

CHAPTER 4

RESULTS

Introduction

The purpose of this study was to describe the behavior of two small groups of 1st-2nd grade children engaged in two different Peer Work Group (PWG) mathematics tasks. The tasks structures were designed to differ by the following features: mathematical content, nature of materials and form of the final product. All interaction was audio- and videotaped and behaviors were coded into categories of individual and group activity by frequency and duration. Information about requests and responses was recorded onto a request-response categories checklist. Pretests and posttests were administered for each task to assess gains and to search for relationships among tasks, behaviors, and achievement. The research questions addressed were

1) What are the (a) general task-related behaviors and (b) specific request-response behaviors and patterns children engage in during PWG tasks (Worksheets Task & Word Problems)?

2) How does task structure affect general behaviors and request-response behaviors during PWG activities?

3) Are there differences in children's achievement scores within and between the Worksheets (WS) Task and Word Problems (WP) Task?

Four boys and four girls were selected for the study. One boy was eliminated from the study on the first day of taping because his family left town unexpectedly, leaving one group of four subjects and one group of three. The researcher worked with the students in their classroom prior to the data collection to familiarize them with her and to train them for functioning in cooperative learning groups. Data were collected as the children worked four days a week for two weeks on the tasks in a familiar mathematics resource room adjacent to their own classroom. Group 1 worked on the Worksheets Task the first week and the Word Problems Task the second week; Group 2 worked on the Word Problems Task the first week and the Worksheets Task the second week. A description of each task was given in Chapter III. The average time per day spent working as a PWG was near equal by task (a difference of only 12 seconds). This enabled meaningful comparisons to be made about degree of involvement in the various behaviors across tasks. The amount of time spent in PWGs (excluding introduction and conclusion, which were led by the researcher) averaged 17 minutes.

The data for the two groups of children were pooled to be presented first as group data and later as group data by task. The data also were broken down by individual children so that some comparisons among subjects could be presented.

Question 1 is first addressed by referring readers to a revised list of behaviors and definitions, including the addition of those not anticipated from the literature review and pilot study in APPENDIX C. Rationale for decisions made about the addition, elimination and regrouping of behavior categories is presented throughout the definitions.

Question 1 is further addressed with tables to illustrate the general behavior categories; five behaviors will be represented by time and six by frequency. Additionally, tables are presented to display children's use of the various request and response categories and patterns that emerged to answer Question 1(b).

Question 2 will be addressed with descriptive statistics via cell means and paired t-tests to illustrate similarities and differences in the general behavior categories across tasks. Statistical tests of significance were not performed on request and response categories data because individual children accounted for repeated requests and responses. Moreover, since each request potentially varied by nine characteristics and each response by seven, these data could not be aggregated by child. Comparisons about these data across tasks will be presented in tabular and expository form.

A table of the results of the achievement tests is presented to illustrate scores for individual children by tasks for Question 3. A statistical t-value for paired means is presented for comparisons of these data because there were repeated measures for individual children (i.e. pretests and posttests for Worksheets & Word Problems Tasks).

General Task-Related Behaviors

The following presentation will provide more information to answer Question 1: What are the (a) general task-related behaviors and (b) specific request-response behaviors and patterns children engaged in during peer work group Tasks (Worksheets & Word Problems)? The first step was to identify relevant general task-related behaviors; these have been listed and defined in APPENDIX C. Eleven general task-related behaviors were ultimately chosen to represent children's behavior during the cooperative learning tasks. Generally, all of the children's actions could be described using these eleven behaviors. Five of these behaviors are discussed in terms of time and six in terms of frequency.

Table 1 presents the total time in minutes that children engaged in Independent Work, Group Discussion, Cooperative Problem-Solving, Waiting for Peers, and Off-Task behavior. Each child usually had several instances of each behavior per lesson (day). Because these data are summed, total amounts of lesson time spent in each general task-related behavior were compared. Clearly children spent the majority of time engaged in Independent Work, more than twice that of any other behavior. Moderate amounts of time were spent engaged in Group Discussion and Cooperative Problem Solving. Relatively little time was spent Waiting for Peers and Off Task indicating that, for the most part, children were actively involved in the assigned work.

Table 2 presents the frequencies for the remaining six general task-related behaviors: Approaching Teacher, Looking at Peer's Work,

Offering Help, Rejecting Help, Requesting and Responding. These data were summed for each behavior across days and tasks. Requesting occurred most frequently, yet only about half of these requests obtained responses. A later discussion of various features of requests may explain why some types of requests were more successful in receiving responses than others. Children were observed Approaching the Teacher about ten times per day for a variety of needs (e.g. to check the accuracy of their work). There were some instances of children Offering Help and relatively few occurrences of the two remaining behavior categories: Looking at Peer's Work and Rejecting Help.

Request-Response Behaviors

The next step for answering Question 1, after looking at task-related behaviors, was to analyze request and response behaviors and patterns. To do this, it is necessary to first discuss how requests were used, then how responses were used, and finally how requests and responses were used in conjunction with each other.

Requests

Table 3 presents frequencies for the Request Categories. There were about equal numbers of high-level and low-level requests made. Fewer confused/frustrated requests were observed. The children made mostly indirect requests. There were slightly more designated requests than non-designated ones.

The majority of revised requests were mitigating, with only a few being aggravating types. Nonetheless, there were 26 repeated requests, which are considered to be aggravated and less effective, bringing the total for aggravated requests to almost twice the number of revised-mitigated requests. These data are largely due to two particular children who made most of the repeated requests. More than one-half of requests obtained responses.

Request Categories Patterns

Table 4 presents data to illustrate patterns among request categories. The majority of requests made were low-level, designated and indirect. While the large majority of high-level requests were indirect, a moderate proportion of these were non-designated. Of 31 direct requests, 29 were for high-level content. About one-fifth of the requests were actually expressions of confusion and/or frustration.

As Table 5 illustrates, the majority of repeated requests were for high-level content as were the majority of revised requests. Although the numbers are small, the majority of aggravated-revised requests were also for high-level content.

Responses

Table 6 presents frequencies for response categories. Of the 187 responses the majority were low-level (non-elaborated explanations) while a moderate number were high-level (elaborated explanations) and about one-fifth were irrelevant comments. A large majority of responses

were judged to be appropriate with respect to the nature of the request. That is, when children chose to respond to requests for help they were prepared to provide help in earnest; there were many occasions when children chose not to respond to requests.

Nearly all responses were given in a timely fashion - this category is not a good indicator of quality of response, however, since it reflects responses of all kinds including refusals and other inappropriate comments. Over half of the responses were understood by the recipients (requestors) and less than 20% were not understood (the remainder being not applicable due mostly to irrelevant responses).

About three-quarters of responses were ultimately used by the requestors. When a student understood an appropriate response he/she typically made use of it and was therefore able to continue with the task. Moreover, 60% of responses could be characterized as appropriate, timely, understood and used, indicating that 35% of requests received responses that were utilized by the requestors. This rate may seem low but at times requestors received good high-level responses but did not utilize them. There were few refusals to provide any information at all, but these reflect only verbal refusals. Inferences were not made about reasons why requestors received no response from peers (i.e., a request which received only silence may have indicated refusals).

Response Categories Patterns

Table 7 presents data to illustrate patterns among some response categories. Both high-level (elaborated explanations) and low-level

(non-elaborated explanations) responses were virtually all appropriate and timely, suggesting that when children did choose to respond to their peers' requests for help they did so quickly and responded with content that met the needs of the requests. Irrelevant responses were, by definition, largely inappropriate, albeit timely.

Table 8 provides more data about patterns within response categories. The categories understood and used should be thought of in terms of the requestor's perspective. Virtually all of the responses which were understood by the requestors were also used by them. The few responses that were understood but not used were most likely interrupted by extraneous events (e.g., task session ended). More low-level response were both understood and used than were high-level responses. Although there is not a great difference in numbers, this may lend support to the conclusion (combined with other data presented above and below about responses) that for these students low-level requesting and low-level responding were the most effective types.

Patterns of Request and Response Categories

Table 9 presents lists of request and response frequencies as a function of day. The first task each group worked on occurred on days 1-4. The groups switched tasks beginning on day 5. The data reveal a pattern for the amount of requesting and responding. There was an increase from number of requests on day 1 to day 2, and a similar but less dramatic jump from day 5 to day 6. More dramatic is the decline in numbers from the 3rd to the 4th days of each 4-day session (less than

half as many on day 8 compared to day 7). Not surprisingly, a similar pattern in number of responses occurred across days, the largest frequencies occurring on the middle two days of each 4-day session. This pattern may be an indication of higher levels of participation and cooperation among group members during mid-week.

Table 10 illustrates the response rate in relation to the various categories of requests. The level of request showed varying results. More than half of high-level requests did receive responses. A greater majority of low-level requests received responses. Although 26% of confused/frustrated requesting behavior did obtain responses, suggesting this behavior could be classified as a form of requesting help, it proved to be only moderately effective since three-quarters of these requests received no responses.

There were differences in response rates due to the request form and whether or not requests were designated to target listeners. The majority of indirect requests were successful in obtaining responses, while the large majority of direct requests did not receive responses. Requests which were designated to particular listeners were quite likely to receive responses: more than four-fifths received responses. Non-designated requests were less likely to receive responses: less than one-third received responses.

A large proportion of mitigated-revised requests received responses. On the other hand, the few aggravated-revised requests were equally as likely to receive responses as not. There were only a total of 6 aggravated-revised requests, however, which is probably not enough

to suggest any pattern. The majority of repeated requests, which can be considered another form of aggravated request because repeating requests often served to aggravate listeners, did not receive responses. Taken together, the majority of aggravated-revised and repeated requests did not receive responses.

While Table 10 presents data about response rates to requests, Tables 11 and 12 present data about the nature of those responses. **Table 11** presents data for request level by response level. Only about half of high-level requests received correspnding high-level responses. And, 30% of high-level requests received irrelevant responses, while only 15% of low-level requests received irrelevant responses. Interestingly, almost 70% of confused/frustrated requests received high-level responses.

Table 12 presents data about the appropriateness of responses by various request categories. Both high- and low-level requests received a majority of appropriate responses. Low-level requests, however, obtained a higher proportion of appropriate responses than did high-level requests: 83% and 67%, respectively. Confused/frustrated requests elicited mostly appropriate responses. Therefore, while this type of request was only about 25% effective in receiving responses, it did have relative success in obtaining useful information.

Only one out of five direct requests received an appropriate response; two were inappropriate. A large majority of indirect requests obtained appropriate responses; these data, too, may be explained by the effectiveness of using indirect forms for eliciting help.

A slightly higher proportion of non-designated requests than designated requests received appropriate responses: 82% and 76%, respectively. Although we saw in Table 10 that designated requests were much more successful in eliciting responses from peers, these data for appropriateness of response may indicate that whether a request is designated to a particular listener or not may have little bearing on the appropriateness of responses received.

Of the 14 responses to mitigated-revised requests, 86% were appropriate. This may be another indication of the effectiveness of revising a request to make it more agreeable to the listener. Only one of the three responses to aggravated-revised requests was appropriate and only two of the seven responses to repeated requests were appropriate. This is only a 25% rate for appropriate responses received by aggravated-revised and repeated requests considered together.

Table 13 presents a more detailed analysis of the value of various responses by listing frequencies for response level by understanding (by the child who received the response). Both high-level and low-level responses were understood by the recipients on a majority of occasions; low-level responses, however, were understood to a higher degree. This would be expected considering the simple nature of low-level responses (non-elaborated, no concept development). Although a smaller majority of high-level responses than low-level responses was understood, it is worthwhile to note that as much as 68% of the high-level (elaborated) explanations given were both appropriate and understood.

In summary, while a majority of both low- and high-level requests received responses, low-level requests received more responses and also were slightly more successful in obtaining appropriate responses. Indirect requests obtained far more responses generally (and more appropriate responses specifically) than did direct requests. Designated requests had both a high response rate and a high appropriate response rate, while non-designated requests had low response rates, but tended to receive appropriate responses. There was very little difference between designated and non-designated requests in receiving appropriate responses. Mitigated-revised requests were very successful both for receiving responses in general and for receiving appropriate responses. In contrast, aggravated-revised and repeated requests were not very successful receiving responses generally or receiving appropriate responses specifically. Further, confused/frustrated requests obtained few responses, but those were mostly appropriate.

Based on these data, the probability of eliciting an appropriate response from peers came from requests that were low-level, indirect, and designated to a particular listener. If these three request features were not successful, then ideally the request would be revised in a mitigating fashion.

Comparison of Behaviors by Task

The following section presents data in the form of tables to address Question 2: How does task structure affect general behaviors and request-response behaviors during PWG activities? To begin with, General Behaviors will be examined (first those measured by time and second those measured by frequency) and then request-response behaviors will be examined by tasks. Complete descriptions of the task structures for the Worksheets and Word Problems Tasks were given in Chapter III.

General Behaviors by Task

Table 14 presents total time (minutes) of involvement for General Behaviors measured by time as a function of the Worksheets (WS) and Word Problems (WP) Tasks. Large differences are evident for Independent Work, Group Discussion, and Cooperative Problem Solving. Table 15 compares mean time of involvement in the General Behaviors by task. A score for each child was computed based on the child's average time per day engaged in each behavior within each task. These scores were summed for the children and divided by 7 (the number of children) to produce the mean scores by task.

There were large differences in level of engagement for Independent Work, Group Discussion, and Cooperative Problem Solving between the Worksheets and Word Problems Tasks, $p < .001$. The largest difference across tasks was for the average amount of time per day each child spent

in Independent Work: 278min in the WS Task vs. 39min in the WP Task. Conversely, much more time was spent in both Group Discussion and Cooperative Problem Solving in the WP Task than in the WS Task. These data clearly point out behavioral differences across tasks. Although children were provided with similar instructions for both tasks regarding expected behavior for cooperation, group responsibility for each person's work and/or individual responsibility for the group, and group rewards for working together, the children exhibited different levels of involvement for these three behavior categories.

There appeared to be a difference in time spent Off-Task although the significnce level was only $p < .08$. Children tended to spend more time Off-Task in the WP Task than in the WS Task. Children also tended to spend more time Waiting for Peers each day in the WP Task than the WS Task (more than twice as much per day). There was a relatively small amount of data for this category and no significant difference for it between the two tasks.

Table 16 presents total frequencies for the remaining General Behaviors summed across children as a function of the WS & WP Tasks. Differences by task type are most evident in number of Requests and Responses; both were much more prevalent in WS Task than WP Task. Children Approached the Teacher more frequently in the WS Task than the WP Task. Meaningful statistical comparisons (t-tests) by task for the behaviors Looks at Peer's Work and Rejects Help are difficult to make because of relatively small amounts of data.

Table 17 presents t-test data for significance of differences between means of WS & WP Tasks for General Behaviors measured by frequency. A score for each child was computed based on the child's average frequency of engagement in each behavior each day within each task. These scores were added for the children and divided by 7 (the number of children). As anticipated from Table 16, differences in amount of Requesting, Responding, and Approaching the Teacher were all significant ($p < .001$., $p < .001$ & $p < .01$, respectively). All three of these behaviors occurred more frequently in the WS Task. Further, although it only occurred fourteen times, there were more instances of children Looking at Peer's Work for information in the WS Task, significant at the .08 level.

In summary, both tasks had considerable amounts of peer interaction as was indicated by the data. However, this interaction took different forms across the two tasks. For example, there were only 76 Requests made in the WP Task compared to 246 in the WS Task. If requesting behavior was used as the only indicator of interaction then it would appear that the children interacted as a cooperative group much more in the WS Task than the WP Task. Request-response behavior is, however, but one of various forms of interaction. Although there were more than three times as many requests made in the WS Task than the WP Task, there was much more Group Discussion and Cooperative Problem Solving in the WP Task than the WS Task.

The WP Task seemed to be the more socially challenging of the two tasks because of the high levels of Group Discussion which involved

The WP Task seemed to be the more socially challenging of the two tasks because of the high levels of Group Discussion which involved cooperation and conflict resolution (e.g., making group decisions and organizing materials and roles). Additionally, Cooperative Problem Solving, involving high-level elaboration for all students involved (e.g., arguing a point with mathematics), was observed a greater proportion of time in the WP Task, suggesting that the WP Task was also the more intellectually challenging task.

Request and Response Categories by Task

Request Cateogories. Table 18 presents percents and frequencies for request categories summed across children for the WS and WP Tasks. The percents were figured on the total number of requests made within each task; there were 246 requests made in the WS Task and 76 in the WP Task. Nearly one-half of requests made in the WS Task were high-level while only about one-quarter were high-level in the WP Task. Slightly more than one-half of requests in the WP Task were low-level while about 40% were low-level in the WS Task, not a great difference. These data should not be taken, however, as evidence to conclude that there was a greater amount of higher order thinking in the WS Task. As mentioned previously, other behaviors occurred that also indicate higher order cognition which must be considered before making conclusions about the overall cognitive challenge in the two tasks. A more complete discussion of this problem will be presented later.

The form of requests was most often indirect; 100% in the WP Task and 87% in the WS Task. There appeared to be no difference across tasks in proportions of designated vs. non-designated requests. Slightly more than one-half of all requests were designated to particular listeners in both tasks.

Because there were only 2 revised requests made in the WP Task it would be difficult to make comparisons about the specific nature of revisions across tasks. In the WS Task 9% of requests were repeated while only 4% of requests in the WP Task were repeated. Repeated requests were always made when no response was received to the initial request.

There was some difference in rate of responses received across tasks: a higher proportion of requests received responses in the WP Task than in the WS Task. A plausible explanation for this is that there was a higher proportion of low-level requests in the WP Task than the WS Task, and low-level requests received responses more often than high-level requests.

There was a slightly higher proportion of confused/frustrated requests in the WP Task than in the WS Task. Virtually all incidents of answered-self occurred in the WS Task. There was also a higher rate of children answering their own questions in the WS Task.

In summary, the most interesting and apparently significant comparisons across tasks for requests were the differences in total number of requests and the greater proportion of high-level requests for the WS Task.

Response Categories. Table 19 presents percents and frequencies for response categories summed across children for the WS and WP Tasks. The percents were figured on the total number of responses made within each task. Similar proportions of high-level responses were made in the two tasks. While in Table 18 we saw that there was a moderate difference in proportion of high-level requests across tasks favoring the WS Task, Table 19 shows a slight difference in proportion of high-level responses favoring the WP Task. A possible implication is that request level may not be a good indicator of response level because children were equally as likely to receive high-level responses, proportionally, across tasks.

There was a small difference in proportion of low-level responses across tasks, 51% in the WP Task and 42% in the WS Task. Nearly one-quarter of all responses in the WS Task were characterized as irrelevant, while only 10% were irrelevant in the WP Task. There were proportionally more inappropriate responses which were also irrelevant in the WS Task. A large majority of responses given in the WP Task were appropriate while a smaller majority were appropriate in the WS Task. Generally, responses were given in a timely fashion with only a minor difference between tasks.

There was a relatively small difference in proportion of responses which were understood (by requestors) between the two tasks, slightly more in the WP Task. There was a slightly greater difference in proportions for responses which were not-understood between tasks -

response category of understood was coded not applicable (N/A) for the WS Task which was due to there being more irrelevant responses given in the WS Task.

Nearly equal proportions of responses were used for both tasks. Almost double the proportion of responses were not used in the WP Task compared to the WS Task. This is partly due, however, to the high number of N/A codes for responses in the WS Task. Virtually all refusals to help occurred in the WS Task and accounted for 8% of all responses in that task. There was only one refusal to help in the WP Task.

In sum, there weren't, proportionally, great differences among the categories of requests and responses between tasks. The biggest difference was in the number of requests generated and, consequently, the number of responses (more in the WS Task). There were, however, a few other notable task differences such as (a) proportionally more high-level requests in the WS Task and more low-level requests in the WP Task, (b) direct requests were all in the WS Task, (d) nearly all occurrences of answered self and refusals occurred in the WS Task, and (d) more irrelevant responses occurred in the WS Task which resulted in more N/A codes for understood and used in the WS Task.

Achievement Results

Question three concerns children's achievement as measured by independent pretests and posttests for the two different tasks: Are there differences in children's achievement scores within and between the WS and WP Tasks? Individual test scores and t-test data to compare correlated test score means across tasks are presented in Tables 20, 21 and 22.

Achievement was measured by administering the WS Task pretest one day before the children worked on the WS Task and the related posttest one day after; the same testing pattern was followed for the WP Task. Because the two groups worked on opposite tasks each week, one group of children was taking a WS Task test while the other group was taking a WP Task test.

Table 20 presents the pretest and posttest scores for each child by task. For the WS Task, the differences between pretest and posttest scores for individual children ranged between -2 and +25 points. Six out of the seven children made improvements in their scores, with an overall average gain of 9 points on a 100 point scale. Figure 1 presents this data graphically to illustrate how individual children's scores vary around a Best Fit Line (dashes) and around a Line of No Difference (slope=1) (solid). The Line of No Difference should be interpreted in the following way. All points which fall above it indicate improvement for those children from pretest to posttest and all points which fall below it indicate that those children did worse from

pretest to posttest; points falling on the line indicate no change. This figure shows that the three children who scored lowest on the pretest also made the largest gains on the posttest: 8, 13, and 25 point gains. One other child also gained 8 points but was not one of the lowest pretest scorers. A similar pattern, however, did not emerge for the WP Task testing data. In fact, the picture for the WP Task scores appears quite different with differences between pretest and posttest scores ranging between 0 and +40 points. Figure 2 illustrates how individual's scores vary around a Best Fit Line (dashes) and around a Line of No Difference (solid). Three children made no improvements and three improved by 40 points on a 100 point scale; one child improved by a relatively moderate 20% which was the overall average gain.

Statistical t-tests for correlated means were performed on achievement scores within tasks to discern differences among the children on test gains. The rationale for using t-tests on these data was presented in Chapter 3. Table 21 illustrates the within group differences for the two tasks. The alpha level was set at .05 and divided by three because a "family of three" t-test would be performed on these data. This resulted in a fairly stringent alpha level of .017 and the hypothesis of no difference between subjects' scores within the WS Task could not be rejected. So, although $t = 2.72$ and would have led to a rejection of the null at the .025 level under single t-test conditions, for these purposes it must be concluded that there were no significant differences among gains made by individual children from pretest to posttest within the WS Task. Table 21 also illustrates a

similar situation for the WP Task. Although there were observed differences among children's gain scores within the WP Task (ranging from 0 to 40 points) it did not prove to be significant at the .017 significance level. Therefore, it must be concluded that the observed differences among the scores within the WS and WP Tasks could have been due to chance. The small number of subjects (N=7) makes all statistical conclusions very tentative.

Table 22 presents t-test data about the differences in achievement gains by tasks. A t-value of 1.39 was obtained and therefore the hypothesis of no difference between gain scores across tasks is accepted at the .017 significance level.

In summary, gains in achievement were observed in 10/14 posttests. There was not, however, a statistically significant difference between individual children's achievement gains from the pretests to posttests within tasks. There also was no statistically significant difference in gains scores between tasks.

CHAPTER 5

DISCUSSION

Research Question #1

General Behaviors

The data reveal that, for the most part, children were actively involved in the assigned work for both the Worksheets (WS) and Word Problems (WP) Tasks. It is interesting that the children spent the majority of time, overall, engaged in Independent Work especially considering that the purpose of Peer Work Groups (PWGs) is to promote peer interaction. Working independently, however, was necessary in both tasks because the tasks were designed to ensure each child would attempt to work out the mathematics. PWG tasks could be designed to have lesser or greater amounts of independent activity depending on a teacher's reasons for choosing this curriculum design. The fairly large amounts of time spent in Group Discussion, Cooperative Problem Solving, Requesting and Responding behaviors illustrate that the children were also engaging in the kinds of peer interaction that serve the purpose of PWG curriculum. The more interesting data lie in the differences among the amount of time children spent engaged in these behaviors across tasks which will be discussed later.

The high incidence of children Approaching the Teacher generally, and in the WS Task specifically, was somewhat surprising considering that PWGs are designed to help children learn to rely on one another. Perhaps the children in this study had more skills in getting help from a teacher than from peers regardless of the training in cooperative learning they received in the initial stages of the study. It is reasonable to assume that if the children had had more experience working in PWGs that they may have been able to rely more on their peers. Other researchers have found that the teacher can become drawn into a group's social structure and the group can come to develop a dependence on him/her (e.g., Webb, 1986).

The children in this study usually did try to exhaust all group resources before coming to the teacher (as they had been instructed to do in the training sessions), but at times met with indifference and/or half-hearted attempts at help from their peers. Longer practice sessions may be necessary to teach children to be more persistent and only approach the teacher when absolutely necessary and to teach children to provide assistance readily when asked by their peers. These data also have implications for task design; that is, the task content and materials should be manageable for the groups so they can accomplish the task without having to rely on the teacher for guidance beyond a reasonable level. Furthermore, the higher level of children Approaching the Teacher in the WS Task may reflect learned norms of behavior from the children's history of classroom experience. That is, if they are

doing a worksheet and run into problems, then they approach the teacher for assistance.

Requests and Responses

The data results for requesting and responding behavior fit the theoretical Effective Speaker Model developed by Wilkinson & Calculator (1982a) in regard to using the nature and form of a request to predict the likelihood of receiving an adequate response. Wilkinson & Calculator's model has implications for PWGs when considering Webb's (1989) Model of Peer Interaction and Learning; that is, that both the requestor and responder benefit from elaborated responses.

Most of the requests made were indirect in form; the few direct requests that the children used were not successful in obtaining responses. This may indicate that the children had learned previously that direct requests (e.g., demanding help) are not the best way of eliciting help from others. These data agree with theory about the effectiveness of various types of requesting - effectiveness being equated with receiving a satisfactory response (Wilkinson & Calculator, 1982a). That is, children who use direct requests (i.e., a statement that could be interpreted as a demand) are not usually effective in obtaining the kinds of replies they desire. Indirect requests are the more socially skilled form, and, as these data confirm, the more successful in eliciting replies.

Children also used expressions of confusion/frustration as indirect requests. Children may have made these frustrated gestures as a way to get attention without having to ask for help. These could be categorized as fairly advanced forms of requesting (manipulative, "coy"), but, since these were only moderately effective in eliciting help from peers, this behavior may alternately have been a less mature form of requesting. The low response rate for confused/frustrated requests may also have been due to hearers' failure to interpret these obscure requests as pleas for help and/or their decisions to ignore them.

The data for designated requests are also in agreement with theory about effective speakers; that is, *designated requests* are more successful in eliciting responses. Almost 70% of non-designated requests did not receive responses while only 14% of designated requests did not. Given the high proportion of unsuccessful non-designated requests, it is surprising that the children made as many as they did. This may be due, however, to the level of social development of the children. For example, calling a person's name or using some other way of assuring one has a listener's attention before speaking is a less egocentric (and, thus, more cognitively mature) way of requesting. That is, the speaker needs to be able to take another's point of view and realize that not everyone is tuned into his/her needs.

The children in this study were still developing their social skills considering their ages (1st-2nd grade). When the children did designate their requests to specific peers it may have been because they

had preferences for certain listeners - perhaps due to friendships or ideas about the probability of receiving helpful information from certain peers. Although it would not simulate actual classroom situations, it would be interesting to compare these data with the requesting behavior of groups comprised of children who did not already know one another. In this way the effects of peer preferences on choosing to designate requests could be studied.

Looking further into patterns of request categories, it seems that the children may not have been skilled in asking for conceptual content-related help from peers (developmental effect and/or less experience) as the relatively high numbers for direct high-level requesting and non-designated high-level requesting would suggest ("effective speakers" use designated requests). Moreover, since the majority of revised and repeated requests were for high-level information, these data may also indicate the children had some difficulty making high-level requests. These children simply may have needed more practice asking for and giving elaborate content-related explanations from and to their peers. More data would be needed, however, to draw any conclusions about the children's skills in making low-level vs. high-level requests using revised and repeated request categories as indicators.

As expected from theory about effective speakers, the majority of repeated and aggravated-revised requests did not receive responses; the majority, however, was not large. Therefore, although these requests were more irritating from an interpersonal perspective, they were at times successful in eliciting responses from peers (perhaps to silence

the "irritant"). The data show, however, that three-quarters of repeated and revised requests received inappropriate responses which further suggests that these types of requests are of little use in obtaining help from peers in primary classrooms. The data for these request categories may also suggest developmental differences between the children in their skills for requesting help because two particular children made most of the repeated requests. For example, repeating a request with force can be considered a less socially skilled way of obtaining the attention of a listener.

While high-level responses are probably the most beneficial for requestors and responders alike, there were more low-level responses given in this study. This probably occurred because there were slightly more low-level requests and there were *proportionally* more responses given to low-level requests than to high-level requests. Perhaps children were more willing to respond to low-level requests because these required less time and effort to answer and/or because children had more confidence in their own abilities to give correct and effective answers in these cases. The relative success of low-level requests was further illustrated by data which showed proportionally more appropriate responses obtained by low-level requests. Given the nature of low-level requests, perhaps it is not surprising that they received more appropriate responses - especially considering the children's ages and limited past experiences in giving elaborate explanations to peers. That is, it may have been easier for the children to respond

appropriately to low-level requests because of the limited demands on the responder under these circumstances.

A requestor only benefits from a response if she/he uses it, and the response can only be used if it is understood (Webb, 1989). It was not surprising that the data showed low-level responses were understood to a higher degree than high-level responses considering the simple nature of low-level responses (non-elaborated, no content development). Still, the majority of high-level responses were both appropriate and understood in this study, which indicates that requestors did, at times, benefit from responders' high-level responses. This indicates that young children (1st-2nd grade) are capable of both providing and using elaborated responses. Therefore, if children are provided with opportunities to practice interacting with peers in cooperative instructional settings, then PWG methods can be effectively implemented in early childhood settings.

Research Question #2

Task Structure Effects on General Behaviors

Data for the General Behavior Categories suggest great differences in level of engagement across tasks for Independent Work, Group Discussion, and Cooperative Problem Solving. These data clearly point out behavioral differences across tasks. Although children were provided with similar instructions for both tasks regarding expected

behavior for cooperation, responsibility of the group for each person's work, and group rewards for working together, the children exhibited very different levels of involvement for these three behavior categories.

The children chose to spend little time solving problems cooperatively in the WS Task even though there were opportunities for this. For example, when a child attempted to give help in response to a peer's request other children could have entered into the interaction in at least three ways: a) a child could have entered spontaneously (especially because of the importance of helping all group members complete the work), b) the child giving the response could have asked other group members to pitch in, or c) a child could have voiced a disagreement about what he/she heard being explained.

The children tended to avoid these possibilities for interaction, however, and probably perceived the task as one in which they should keep to themselves unless asked a question. This occurred despite the earlier training sessions when the researcher encouraged the children (and they encouraged each other) to provide help and put their heads together to solve problems while working on tasks similar in form to the WS Task. When they were put in the groups for data collection and given their individual work folders, however, they spent most of their time working independently.

Because of the WS Task's interactive structure (a feature of the task structure which dictates how children should interact) it simply was not necessary for the children to interact unless they encountered

some difficulty with their work. Moreover, when children were asked a question it seemed at times to be interpreted as a nuisance, an interruption in their personal work, as was evident in their facial expressions and sighs. Furthermore, during both the training and data collection sessions for both types of tasks, the children were at times reluctant to provide help to certain peers. In the future it would be worthwhile to study interpersonal relationships (e.g., friendships, peer status) and probability of requesting and receiving help in PWGs.

The children spent more time Off-Task in the WP Task than in the WS Task, although this difference proved only to be moderately significant. The higher rate for Off-Task behavior in the WP Task is most likely due to children who simply let others figure out the word problems without contributing to the work themselves. The possibility for this behavior is inherent in a task, like the WP Task, where a group is given one problem to work on and there is not a predetermined division of labor in the task design. For example, one child frequently contributed nothing to the group and only watched while the other children struggled with the word problems. He then would share in the final answer, however, by feigning interest and nodding approval - he took on the role of the "free-rider" (Salomon & Globerson, 1989).

This free-rider effect had a greater probability of occurring in the WP Task because the answers really depended on the performance of the most able member. The possibility of a free-rider effect increases as the group size increases and in this case the boy who exhibited this behavior was a member of the larger group (n=4). It would be necessary

to analyze the data further to describe the Off-Task behavior before making conclusive statements about how the structure of task might influence the nature of Off-Task behavior in PWGs.

These data for Off-Task behavior have important implications for designing PWG tasks. It may be that, for particular children to become involved in tasks that have a singular group-product design (e.g., one correct answer submitted by the group), it may be best to use a task that is subdivided so that each child has a piece of the task to be responsible for (e.g., the jigsaw method, Aronson, 1978). This type of task design would increase their responsibility to the group, making it more tangible. It appeared that individual children's sense of group responsibility and their perceived value of a task's incentive system differed. Children's task-related perceptions, therefore, may be worth studying to better understand how PWG processes vary by individual children.

Children also tended to spend more time Waiting for Peers each day in the WP Task than the WS Task (more than twice as much per day). The relatively insignificant difference between these means may be due to the small amount of data obtained for this category. The trend toward more wait time in the WP Task is most certainly due to the fact that children who figured out a problem in this task had to wait for other group members to try out the problem before they shared their work and reached agreement about the final answer (norms set by one group in particular). For example, one child had to wait repeatedly for his group members because they did not want to have his help in figuring out

the word problems. Because he was usually quicker than the others, he would often be left waiting.

Although it only occurred fourteen times, there was a moderate difference between tasks for instances of children Looking at Peers' Work for information - more in the WS Task. In both tasks, children had individual papers to work on and each child was accountable for attempting all problems. In the WS Task, however, the papers were of the traditional worksheet format and individual children were at varying points in this work at any given time. Therefore, some of this data may have been due to children checking the progress of peers. Furthermore, since 11 requests were refused help in the WS Task, children may have "looked" to avoid the risk of annoying their peers and perhaps being refused information.

It seems clear that the task structures, represented by the materials and procedural instructions given the children, and the children's perceptions of expected behavior patterns across tasks, accounted for the large difference in amount of Requesting behavior between the tasks. Because children were focussing on their own worksheets in the WS Task, they needed to make a request in order to initiate an interaction. In the WP Task, on the other hand, the children had many more continuous verbal interactions from the beginning of each session (day), and each word problem, that often flowed from a group discussion about who should read the problem card to a cooperative problem solving episode as they discussed and/or argued about how to attack the problem. Here, the interactions often precluded the

necessity to make requests for help in order to initiate peer interaction. It appeared that in the WP Task the groups functioned as a "social system" and in the WS Task they functioned as "a group of individuals working alone side-by-side" (Salomon & Globerson, 1989).

Task Structure Effects for Requests and Responses

Although there were large differences in the numbers of requests and responses between the two tasks, there were only a few apparent differences regarding the specific categories of requests and responses (i.e., *types* of requests and responses used) between the two tasks. Direct requests, which are a form of demanding help, all occurred in the WS Task and seemed to indicate a higher frustration level. Similarly, it is possible that the small difference in response appropriateness between tasks was due to less group cohesiveness and the higher frustration level which seemed to exist in the WS Task (more inappropriate responses given in the WS Task).

Occasionally, children who were asked a question by their peers in the WS Task seemed to feel bothered, being distracted from their own work. This may have been, in part, a result of the individual accountability that was more readily assessable in the WS Task (individual worksheets and folders) compared to the WP Task. That is, the children may have been more concerned with receiving help in order to move quickly through their work and to get the correct answer because they knew their papers would be handed in to the teacher and corrected. This mode was the one they were familiar with in their classroom when dealing with mathematics worksheets and may have been a stronger influence on the children's feelings about which aspects of the task were most important regardless of the group reward system (i.e., getting one's own work completed is more important than helping peers).

Furthermore, the children may have perceived this type of work (mathematics worksheets) to be very important (Stodolsky et al., 1991) and therefore may have been more concerned with their performance in the WS Task than in the WP Task. This in turn may have led to more demands for help (direct requests).

If these children had more experience working in a PWG mode, however, they might have perceived that helping the group in some cases was more important 'work' than completing their own worksheets quickly and accurately. It would be interesting to study children's perceptions of two or more PWG tasks that varied by task structure elements. It would also be worthwhile to know if the children considered the WP Task to be something besides "mathematics" and, as a result, less important than the WS Task.

In summary, both tasks had considerable amounts of peer interaction as was indicated by the data. However, this interaction took different forms across the two tasks. For example, there were many fewer requests made in the WP Task compared to the WS Task. If requesting behavior was used as the only indicator of interaction then it would appear that the children interacted as a cooperative group much more in the WS Task. Request-response behavior is, however, but one of various forms of interaction. Although there were more than three times as many requests for help made in the WS Task, there was much more Group Discussion and Cooperative Problem Solving in the WP Task.

The WP Task seemed to be the more socially challenging of the two tasks because of the high levels of Group Discussion which involved

cooperation and conflict resolution (e.g., making group decisions and organizing materials and roles). Additionally, Cooperative Problem Solving, involving high-level elaboration for all students involved (e.g., arguing a point with mathematics), was observed a greater proportion of time in the WP Task, suggesting that this task was also the most intellectually challenging task from a socio-cognitive point of view (e.g., peer interaction can create cognitive conflict within individuals who have to restructure their thinking to accommodate for the new, and conflicting, information). For example, there was an occasion where a group of three children did not agree on the answer for a word problem but needed to come to group consensus before moving on to the next problem. The children voiced their disagreement and challenged each other to prove why they thought their answers were correct. Two of the children, in turn, demonstrated the mathematics on paper and verbalized their logic used to solve the problem and eventually decided on the correct answer. Moreover, although there were many more requests made in the WS Task than in the WP Task, there were near equal proportions of high-level responding for both. This suggests further that there was less high-level elaboration (high-level responding + cooperative problem solving) in the WS Task than in the WP Task.

Upon viewing the videotapes it became obvious that the children functioned as a more cohesive group in the WP Task. For example, as the groups began new word problems they immediately got together and consulted about logistics (negotiating whose turn it was to read) and about how to attack the problem (deciding whether to use addition or

subtraction, and in which order the numbers should be placed). This is not to imply that there was not arguing and/or Off-Task behavior, but rather that there seemed to be a shared perception of the need to share resources (materials and intellects). That is, there seemed to be the understanding that the WP Task was a cooperative venture and/or that the groups were functioning as an established social system.

The most evident differences between the two task structures was in the materials and nature of final products; these, therefore, can be considered the task structure features most responsible for the observed differences in children's behavior across tasks. That is, the materials and form of the final products dictated the interactive structure for the children. These task sructure features provided cues for the children about the level of cooperative interaction necessary to accomplish the given tasks and therefore guided the nature of the peer interactions.

I believe that it is because of these two task structure features that the children mutually perceived the WP Task as 'groupwork' but seemed to have varying perceptions of what their roles were supposed to be in the WS Task. Their interpretation of the expected patterns of behavior for the WS Task hovered between 'confidential seatwork' to a 'helping group' where children at times had to remind peers that they were supposed to be helping one another. It seems that the nature of the materials overshadowed the procedural instructions for cooperation and for group responsibility in the WS Task and influenced the children's perceptions of the interactive structure.

Research Question #3

Children's Achievement Within and Across Tasks

Although there appeared to be differences in children's achievement scores within task conditions, they were not statistically significant. There seemed to be a trend toward children who scored lowest on the WS Task pretest making the largest gains on the WS Task posttest. Although the children chosen for this study were all considered in the top one-third of their class mathematically by their teacher, comparison among the children's pretest scores and their gains in achievement may suggest an "ability" effect for achieving in PWGs (Webb, 1985). Because this trend was not seen in the WP Task testing data, the large gains these children made may have been a function of the mathematical content and/or task structure of the WS Task. That is, an ability by treatment interaction effect may explain these apparent task differences in individuals' achievement gains; the "lower ability" children may have thrived in the WS Task setting (treatment) (Peterson et al., 1981).

A replicated study with a larger sample size may show different statistical outcomes for achievement among individuals. And, if this occurred, comparisons could be made between individuals' behavior during PWG activity and achievement. This, however, may prove to be a very complicated undertaking when the goal is to describe language behavior in detail, in a true sociolinguistic style, and search for relationships between process and outcomes as was the original intent of part of this

study. Merging the sociolinguistic and process-product paradigms appears to be quite complex and may be problematic (Carlsen, 1991). This, however, would still be a valuable long term goal of this work, to further refine the research methods and work towards incorporating both paradigms effectively.

Searching for relationships between processes and outcomes using behavior categories with broader definitions appears to be a simpler task at this point. For example, debilitating group behaviors (such as the free-rider effect mentioned previously) affect group functioning and therefore can affect the cognitive effort group members exert. These behaviors could occur on the individual and group levels and could potentially affect differences in achievement between individuals and between groups. For example, the free-rider effect has the potential of affecting not only the "free-rider" himself but also the other group members. In this study, this particular debilitating behavior may have reduced some of the potentially positive cognitive effects of Cooperative Problem Solving, which occurred more in the WP Task, and therefore washed out differences in achievement gains between tasks. A within task, between group comparison could be looked at next to see if, for example, there is a relationship between groups' respective amounts of cooperative interaction and achievement gains.

An alternative explanation for the lack of significance of difference in achievement between tasks may be that the children did what was necessary to accomplish each task and to make moderate achievement gains (only one child lost points from pretest to posttest

{-2 points in the WS Task}). That is, the children shifted their behavior across tasks and were able to meet the demands of each activity. So, although there was more socio-cognitive interaction in the WP Task, this did not result in higher achievement gains there.

Limitations

This study is limited by the small number of students involved and by the relatively short duration of the PWG sessions. Furthermore, the stability of the results should be cross-validated with groups that are more heterogeneous by ability.

Because the task content was different between the two tasks (fractions & multiplication vs. addition & subtraction with word problems) and because different subject matter content could require different cognitive effort for success, it would be important to design a study with the same content and only change the interactive structure and form of the final products (group vs. individual) before making any conclusions about the effect of task structure on children's achievement. The children's behavior would most likely be different because of the different task contexts (Day & Libertini, 1991) but one would want to search for differences in learning under these two task conditions. A larger sample size than that used in this study would be needed because the same groups of children could not be used in both conditions.

Furthermore, the tests differed in the number of items the children needed to respond to and in the point system used for scoring across the two tasks. This may have interfered with making good comparisons between achievement on the two tasks. This problem could be dealt with in future studies by administering tests that were more similar across tasks and this would be made easier if the same subject matter content was used also - altering only the task structure to search for task effects.

Conclusion

This study provides some detailed information about what children actually do in small peer-directed work groups and provides evidence that children's behaviors will vary according to the structure of the tasks. Eleven general behavior categories were identified which adequately describe the independent and interactive behaviors of two groups of children working on two different mathematics tasks. Patterns which emerged for request-response behaviors agree with sociolinguistic theory about "effective speakers" and have implications for the nature of peer interaction and learning in PWGs, especially in primary classrooms.

Differences were found in children's behavior across the two tasks. It is proposed that features of the learning tasks (specifically, the nature of the materials, form of the final products, and interactive structure) are variables that affect behavior in PWGs. The degrees of

equality and mutuality of learning tasks may be quite useful for describing small group task structures and explaining individual behavior and peer interaction (Damon & Phelps, 1989). Group process models that have a framework based on requesting and responding behavior may be appropriate for studying peer interaction and learning for cooperative tasks where the group is actually functioning as a few individuals working alone side-by-side. Other types of PWG tasks, however, appear to require different group process models to describe students' interactive behaviors. For example, to examine the processes of a group that is working on a task as a team with a high degree of interdependence one may need to adopt a point of view of a PWG as a "social system with behaviors and cognitions that are interconnected and reciprocal" (Salomon & Globerson, 1989, p).

The next step for this project would be to further analyze the behaviors within the Group Discussion and Cooperative Problem Solving episodes to further examine the peer interdependency and the cognitive effort of each group member. These data would more fully describe the interaction and help to discern individual children's roles within these episodes. For example, Group Discussion could be examined to see if groups actually expended more effort trying to do away with effort requirements of the tasks (Salomon & Globerson, 1989).

Research into students' perceptions about PWG tasks and about relationships among group members would add to our understanding of PWG processes. Students' perceptions may play an important role in dictating how they choose to behave in PWGs. It would be useful to

interview students to try to discover their perceptions of: a) the importance of the task, b) their motivation to accomplish the task, c) team interdependence across tasks, and d) the value of working with peers across different types of tasks.

Although differences in children's achievement scores within and between groups and tasks were not significant, studying the same subject matter content under different task structure conditions with a larger sample size may prove otherwise. It is probable that children's engagement in specific group process behaviors would relate to gains in achievement as was found by other researchers.

If using a process-product paradigm, other PWG context variables that may affect the group process and should be studied are group size, duration of PWG activity and frequency of meetings, and varying reward systems used with same task content. Furthermore, more evidence of long term effects of participating in a PWG should be obtained (Phelps & Damon, 1989).

This study has implications for classroom practice. One may be that teachers would look very carefully at their goals and rationale for using small group learning methods and then would consider a body of knowledge about PWG task structures. In this way educators could design optimal tasks for eliciting the kinds of behaviors that would best achieve their social and academic educational goals. For example, if the major goal was to improve students' self-esteem through opportunities for taking on "expert" roles while teaching their peers,

then one optimal PWG design would allow for many occasions where the children could respond successfully to peers' requests for help.

APPENDIX A

CONSENT FORM

TO THE PARENTS OF

FROM: Gail Libertini
Early Childhood Education Department
Furcolo Hall
University of Massachusetts
Amherst, MA 01003

Hello,

I am a graduate student at UMASS and am preparing a dissertation project about cooperative learning methods in mathematics with children between the ages of six and eight years. Cooperative learning involves assigning children to small groups to work together to complete a given assignment. At times the children may simply be helping each other complete individual math worksheets and at other times they may be working to solve mathematical word problems as a group. My interest lies in the interaction between group members, such as the means by which children give and receive help. I am especially interested in searching for and analyzing effective explanations peers give one another.

I have been working with your child's teacher, Ms. Langley, to develop appropriate mathematics lessons to use with two small groups of 4 children in her classroom. These lessons will be drawn from the curriculum that the children would normally be working on. I also have been volunteering in the classroom to help with math instruction. Because of this contact, the children and I are becoming comfortable with one another. Prior to the group work, I plan to familiarize the children with cooperative learning. In this way they will be prepared to ask clear questions and provide help to a peer who asks for it. The children will be encouraged to make sure everyone in the group understands how to solve the problems. Each day during the study Ms. Langley or I will introduce the lesson and then monitor the groups to encourage the children to help one another and to clear up any misunderstandings. Before and after the study, the children will be given short math quizzes (based on the work they do in their groups) to assess the effectiveness of these cooperative learning methods.

In order to study the interactions between the children and to analyze the types of explanations they give and receive it will be necessary to videotape the groups as they work. The videotapes will remain completely confidential; neither the children nor the school will

be identified by name in any discussions about the project or in my dissertation. If the tape is ever used as a demonstration of cooperative learning, every effort will be made to assure anonymity. Also, if a paper is published based on this research, the children will not be identified by name.

I would appreciate your permission as parent or legal guardian to allow your child to participate in this study. If you would give your permission, please sign below and return to Ms. Langley. If you change your mind later about your child's participation in the study, please contact me or Ms. Langley and I will arrange to exclude your child from the videotape analysis. I will be happy to answer any questions you may have about this project (phone # 665-8459 evenings).

Thank you for considering my research project. I look forward to the possibility of working with your son or daughter.

Sincerely,

Gail Libertini

DO NOT DETACH. PLEASE SIGN AND RETURN ONE COPY OF THIS FORM. YOU MAY KEEP THE OTHER COPY FOR YOUR RECORDS.

Parent or Guardian's Consent: I, _____, give my permission for _____ to participate in the study described above.

Signature: _____

Date: _____

APPENDIX B

ORIGINAL BEHAVIOR CATEGORIES AND DIFINITIONS

It is indicated in **bold type** in parentheses when behaviors were ultimately changed or eliminated.

Requests*

Requests for Information: Requests for information will be coded as either high-level or low-level. Requests for action will not be coded.

High-Level Request: A request for an explanation of how to solve a problem or to gain greater understanding of a concept.

Low-Level Request: Often this may be a request for procedural information (i.e. about the logistics of the task). It also includes requesting an answer, a needed fact about task-related content, or managerial information ("How much time is left?"). A low-level request may be satisfied, for example, by a terminal response (one-word answer).

Direct Form: For clarity of speech, speakers may minimize ambiguity by explicitly stating the agent, action, and object in the utterance using direct forms. Direct requests express the content, H(hearer) will do A(action), directly either in imperative utterances, e.g. 'Open the door' or with a performative marker, e.g. 'I request that you open the door'. A method of identifying a direct request is to ask the following question: 'Can the utterance be prefixed in its particular context with a performative tag such as 'I request (that),' 'I command (that)' or 'I order (you to).'

Indirect Form: One type of indirect request embeds the content, H will do A, into an utterance whose matrix clause references one of the 4 sincerity conditions described below. e.g. 'Wanna show me how you got that (answer)?'

a) S wants H to do A.
b) S assumes H can do A.
c) S assumes H is willing to do A.
d) S assumes H will not do A in the absence of the request.

Designated Listener: Speaker designates a particular listener to which a request is addressed - usually by using the listener's name or nonverbally with proximity cues.

Revision: Effective speakers are flexible in issuing their requests, particularly when compliance is not obtained. Revising their initial request by providing additional information or by altering the "directness" of the request may be more effective than merely repeating the same request. However, a revised request can be either mitigating or aggravating. Mitigation refers to softening the request so as to avoid

creating offense, while aggravation refers to increasing the force of the request, such as by repeating the same request in the same way several times.

*The definitions about requests were adapted from Garvey, 1975; Labov & Fanshell, 1977; Wilkinson & Calculator, 1982a, and Webb, 1989. The four sincerity conditions were taken from Labov & Fanshel, 1977.

Responses**

High-Level Elaboration: Consists of explanations, typically descriptions of how to solve a problem or for the purpose of helping a peer understand an unfamiliar concept. Often high-level elaboration includes a demonstration.

Low-Level Elaboration: Includes the answer to a problem, giving non-elaborated information ("a nonelaborated response which consists of the explainer providing a simple but appropriate response to a content related question", Peterson, Wilkinson, Spinelli & Swing, 1984, p131), procedural information (e.g. the location of problems in the book), and managerial information about nonacademic content.

Understood: The student who is the target of an explanation understood the information received and shows this in some way.

Opportunity To Use The Help (Changed to "Timeliness".): The response is given in a timely fashion so that the target student recognizes the help, and has the opportunity to use the information. That is, the target student has the time and resources available tc use the help (explanation) to solve the problem (correct an error, clarify a concept, etc.).

Uses Opportunity (Changed to "Used Help".): The target student uses the opportunity (see above) to solve the problem with the new information provided by a peer.

Appropriate: A response that would be judged to be appropriate considering the nature and content of the request. (This does not necessarily mean that the person who made the request is satisfied).

Inappropriate: A response that is inappropriate considering the nature and content of the request (In this case the person who made the request is always not satisfied).

**The definitions about responses were adapted from Webb, 1989.

General Definitions

Answers Self: After making an error or requesting information, the student solves the problem or answers the question independently (with no assistance from others).

Off-Task (Redifined to exclude waiting behavior): The student is clearly not engaged in task related activity. He or she may be waiting for the teacher, for peer(s), or for materials. The student may be 'fooling around', daydreaming, or may have left the group for some non-task related reason.

Does Work for Peer (Eliminated): In this case the student, in an attempt to help a peer, simply does the work for the peer. There is no explanation to accompany this work - it is not part of a demonstration. The student may, for example, be just trying to hurry the peer along with the work.

Offers Unsolicited Help (Changed to "Offers Help".): The student may perceive that another student is having difficulty and offer to help. However, in this case the student was not asked by the peer to help either with a direct or indirect request. In fact, the help offered may not be welcomed by the peer.

Rejects Help: The student rejects a peer's attempt to help. The student most likely did not request assistance. However, the student may have requested assistance but for some reason decides she/he does not want a response from this peer specifically, or from anyone.

Works Independently (Changed to "Independent Work".): The student is working alone on the task and may be talking to herself and/or may make an occasional comment to the group.

Dyadic Interaction (Eliminated. Dyadic interaction was included in other behaviors categories {Group Discussion, Coop. Prob-Solv., and Request-Response sequences}): Two students are working together (collaborating and/or tutoring) at the exclusion of the other students in the group.

Nonacademic Task Behavior (Eliminated.): The student is on-task, using appropriate materials, but the behavior is non-academic. For example, cutting and pasting parts of a map for the group's finished product.

Orients Other(s) to Task (Eliminated. This would be inluded in Group Discussion): This describes leadership behavior when a student reminds another student that it is time to get to work or that she is on the wrong page, etc.

Reprimands Peer (Eliminated. This would be included in Group Discussion): Similar to the above definition but is different in the tone in which the remark is said. A student may show aggravation/anger towards another student for not getting to work (task-related) or for

other reasons not related to the task - for example, socially annoying behavior, e.g., "Sue, you're not doing your share of the work!"

Makes Plea for Cooperation (Eliminated. This would be included in Group Discussion.): The student takes some responsibility for the functioning of the group and reminds people to work together and help one another to complete the task (solve the problem). e.g. "We're supposed to be cooperating."

Disagrees/Argues (Eliminated. This would be inluded in either Group Discussion or Coop. Prob.-Solv.): The student voices disagreement and may or may not engage in an ongoing argument with one or more peers about a either a procedural or content related event. These topics might include logistics of the task, the method of attack to solve a problem or the answer to a mathematical problem. The disagreement must be related to the task (not social).

Talks Socially (Eliminated. This would be included in Off-Task.): The student is conversing about something completely unrelated to the task at hand. The student should be considered off-task.

Group Discussion/Decision Making (Changed to "Group Discussion".): This would include brainstorming with two or more peers about the task. e.g. A discussion may be about how to solve a problem or about what part of the task they should begin with. The student may be speaking or listening but it should be obvious that he is involved in the discussion.

Calls Out Answer (Eliminated.): The student takes it upon herself to call out the answer to the group. This is an unsolicited exclamation. (e.g., The student working independently on a problem shouts out "I got it! The final answer is 35!"

Looks at Neighbor's Work: The student quietly looks at someone else's work in the group, usually to check her own work or to see what to do next. Being a cooperative task, this is okay. The student does not ask for help; she simply may lean over and take a look.

Approaches Teacher: The student chooses to ask a teacher or other adult in the classroom for assistance with the content of the present task (e.g., "Will you help me do this problem?", "Is this correct?") or for procedural information (this may include asking how much time they have left, or asking if they can use reference books for assistance).

Overtly Shows Confusion/Frustration: The student does not ask for help but is obviously having difficulty and shows it by expression. (e.g., The student sighs heavily and puts her head down on her desk, pushing away the paper she was working on).

Rejects Peer's Attempt to Help (Changed to "Rejects Help".): The student may or may not have asked for help but at some point while a

peer is trying to provide help, the student rejects it. (e.g., "I can do it myself!")

APPENDIX C

REVISED BEHAVIOR CATEGORIES AND DEFINITIONS

Following is the revised list of behaviors and their definitions used in examining the children's engagement during the two PWG tasks. This list is presented to begin to answer Question 1: What are the general task-related and specific request-response behaviors children engage in during two PWG activities? These behaviors were distilled and reorganized from a larger list generated from the literature and pilot study (see previous Appendix) and were chosen because they occurred repeatedly across children. It is indicated in **bold type** and in parenthesis when a category was added (not in the original list).

General Behaviors: These were first coded by time; the latter six were re-coded as frequencies.

Independent Work: The student was working alone on the task and may have been talking to him/herself and/or made an occasional comment to the group.

Group Discussion: Two or more students engaged in talk about the task. It most often involved a discussion about the logistics of the task such as whose turn it was to read the problem, or what part of the task they should begin with. At times it took the form of group decision making, most often occurring at the beginning of a session or during transitions within a task. The student being observed may have been speaking or listening but it was obvious that he or she was involved in the discussion.

Cooperative Problem Solving: Two or more students worked together to find a solution to a content related problem. Sometimes this occurred as a result of one student's request for information when the listener did not have the resources to provide help. For example, two girls puzzled over how to attack a word problem and read the problem over three times together to gain understanding. Another example came about when two students disagreed on the answer which resulted in an argument about how to set up the mathematics for a word problem.

Waiting for Peers (This category was added.): This was coded when a child was not engaged in task-related activity because he/she was waiting for one or more peers. This occurred, for example, when a child had to wait for others in the group to figure out the same problem before they could all check their answers and continue on with the next problem.

Off-Task: The student clearly was not engaged in task-related activity. The student may have been 'fooling around', daydreaming, or may have left the group for some reason unrelated to the task at hand.

Approaches Teacher: The student chose to approach the teacher (researcher) in the classroom for assistance in understanding task content, to check the accuracy of an answer, or to obtain procedural information.

Looks at Peer's Work: The student quietly looked at a groupmate's paper, usually either to check the accuracy of his/her own work, to determine what to do next, or to copy an answer. This was not accompanied by a request for help.

Offers Help: The student perceived that another student was having difficulty and offered help. In this case the student was not asked to help either with a direct or indirect request. In fact, the help offered may not have been welcomed by the peer.

Rejects Help: The student rejected a peer's attempt to help. The student most likely did not request assistance. However, the student may have requested assistance but for some reason decided he/she did not want a response from this peer specifically, or the student simply changed his/her mind.

Requests: The student made a request to a peer for information or assistance.

Responds: The student gave a response to a peer who had made a request for information or assistance.

Request Categories: Requests refer to all solicitations for information made by students and varied by form and content. The level of information requested was coded when possible; requests for action were not coded. A child who made a request will be referred to as a "requestor". The definitions about requests were initially adapted from Garvey, 1975; Labov & Fanshell, 1977; Wilkinson & Calculator, 1982a; and Webb, 1989, and were altered upon data collection to include all relevant and recurring request behaviors. The four sincerity conditions were taken from Labov & Fanshell, 1977.

Level.

High-Level Request: These were requests for explanations of how to solve problems or to gain greater understanding of concepts. For example, "How do you do this?" General pleas for help (e.g. "Help!") were also coded as high-level because these most often implied a lack of understanding and at times elicited explanations from peers. However, if it was obvious that the "help" plea was for something like information about what worksheet to do first (i.e. procedural information), then it was coded low-level.

Low-Level Request: Often these were requests for procedural information (i.e., about the logistics of the task). These also included requesting an answer, a fact about task-related content, or

managerial information (e.g. "Whose turn is it to read?"). A low-level request often could have been satisfied by a terminal response (one-word answer).

***Confused/Frustrated (C/F) (This category was altered to be considered a type of Request):** This behavior was identified when a child was obviously having difficulty and showed it by nonverbal expression (e.g., throwing down one's pencil in frustration), sighing audibly or engaging in self-talk such as muttering comments like, "This is hard". Sometimes this behavior elicited responses from peers. This category was added as a separate level of requesting because it occurred frequently and was at times interpreted by peers as a plea for help. It was not, however, possible to discern whether the requestor desired high- or low-level information from the behavior itself. Confused/Frustrated requests were always coded as indirect in form.

Form. All requests were coded as either Direct or Indirect.

Direct Request: This type of request had minimum ambiguity because the speaker stated the agent, action, and object in the utterance using direct forms. Direct requests expressed the content, H(hearer) will do A(action), directly either in imperative utterances, e.g. 'Help me' or with a performative marker, e.g. 'I request that you help me'. A method of identifying a direct request is to ask the following question: 'Can the utterance be prefixed in its particular context with a performative tag such as 'I request (that)', 'I command (that)' or 'I order (you to)'?

Indirect Request: These were identified as requests whose content, H will do A, was embedded into an utterance whose matrix clause referenced one of the 4 sincerity conditions described below. (e.g. 'Wanna show me how you got that answer?')

a) S wants H to do A.
b) S assumes H can do A.
c) S assumes H is willing to do A.
d) S assumes H will not do A in the absence of the request.

Designated Listener.

Designated Request: This was coded when a speaker designated a particular listener to be the recipient of the request. A speaker designated a listener by either using the listener's name (e.g. 'Lin, can you help me?') or by using nonverbal proximity cues (e.g. leaning one's body toward the designated listener and directing the voice to him/her). This category was coded either as 'yes' or 'no'; if a 'yes' was coded then the identification of the targeted listener was coded.

Revision.

Revised Request: Students sometimes made revised requests when compliance was not obtained for the original request. Students may have

revised their original request by providing additional information or by altering the "directness" of the request (e.g. from 'Help me' to 'Lin, can you help me with this one?'). Each revised request was coded as either mitigating or aggravating.

Mitigated (Revised) Request: This was coded when a child softened a request so as to avoid creating offense or irritation (e.g. from 'Help me!' to 'Will you help me?').

Aggravated (Revised) Request: This was coded when a child increased the force of the request, such as by switching from an indirect to a direct request (e.g. from 'Will you help me?' to 'Help me!').

Repeated Request (Added): This was coded when a child repeated a request verbatim; it may be considered an aggravated form because of its irritating potential.

Response to Request.

Receives a Response: A child either did or did not receive a response to each request. Therefore, for every request either 'yes', 'no' or 'answered self' was coded for this category.

Answered Self: This was coded when a requestor solved the problem or answered the question independently. Sometimes this involved a rejection of a peer's response, for example: "Forget it, I figured it out on my own". This was only coded when it was obvious (usually with a verbal announcement) that the child resolved the problem. This precluded a 'yes' or 'no' code for Receives Response category.

Response Categories: These refer to all replies made by students to a peer's request for information; these also varied by form and content. A child who made a response will be referred to as a "responder". The definitions about responses were originally adapted from Webb (1989) and revised upon data collection to include all relevant and recurring response behaviors for these early elementary peer work groups.

Level.

High-Level Response: This type of response included elaborations consisting of explanations, typically descriptions of how to solve a problem or efforts to help a peer understand an unfamiliar concept. This category was also expanded to include some procedural explanations that required a fairly deep understanding of the material. An example of a high-level procedural response involved a child who explained that one part of a mathematical problem needed to be completed first in order to complete the second part (this was a conceptual response to a low-level request concerning what the children were supposed to do first).

Low-Level Response: This type of response included answers to problems, non-elaborated content related information, procedural information (e.g. the location of problems), and managerial information about nonacademic content (e.g. location of materials, issues of work time).

Irrelevant (Added): The addition of this category was necessary to set apart a group of responses that could neither be considered high- nor low-level. This category includes non-content-related responses: a) refusals to help (e.g. "Do it yourself!"), b) responders' acknowledgements of their inability to help (e.g. "I don't know how to do it either."), and c) irrelevant comments that may have indicated the responder did not understand the request; these were coded 'inappropriate' (see below). A few Non-Level responses were content-related responses that were interrupted by extraneous events or time constraints. In these cases the response may have been judged 'appropriate' or 'not applicable'(see below).

Appropriateness.

Appropriate Response: Both high- and low-level responses were coded either appropriate or inappropriate. A response was judged to be appropriate if it met the needs of the request (based on the nature and content of the request). Appropriate responses did not necessarily satisfy the person who made the request (i.e. the requestor may not have understood the response). In a few instances 'not applicable' was coded for appropriateness, these were cases where a potentially appropriate response was aborted (e.g. interrupted).

Inappropriate Response: These were responses that were inappropriate considering the nature and content of the request. In these cases the requestor was not satisfied. This category included refusals to help, wrong answers, and responses like: "I don't know how to do it either". If a response was coded 'inappropriate', then 'not applicable' was coded for the categories 'understood' and 'used'.

Timeliness.

The response was judged to be timely if it was given relatively soon after the request was made so that the requestor recognized the help and had the opportunity to use the information. That is, the requestor had the time and resources available to use the new information for potentially solving the problem (correcting an error, clarifying a concept, etc.).

Refusals.

Refusing to help was coded as a response, albeit inappropriate. For example, a child may have responded to a peer's request with, "Do it yourself!"

Usefulness of Response (requestor's perspective).

Understood: It was evident that the student who was the target of a response (the requestor) understood the new information. Responses that were coded Irrelevant (see above) received 'N/A' codes for Understood.

Used Help: The requestor used the information obtained from a peer's response to solve the problem (correct work, clarify ideas). Responses that were coded Irrelevant received 'na' codes for Used Help.

APPENDIX D

OBSERVATION INSTRUMENT

Children's Behavior in Peer Work Groups

Child's I.D. Date

Lesson/Task Time

Peers Present

Observer's I.D.

Summary of Teacher's Introduction:

Lesson Objective:

Task Procedures:

Physical Structure of the Setting:

REQUESTS I.D.

REQUEST SEQUENCE	1	2	3	4	5	6	7	8	9	10	11	12
REVISION												
HIGH-LEVEL												
LOW-LEVEL												
DIRECT FORM												
INDIRECT FORM												
DESIGNATED LISTENER												
AGGRAVATED												
MITIGATED												
RECEIVES RESPONSE												
RECEIVES NO RESPONSE												

RESPONSES I.D.

RESPONSE SEQUENCE	1	2	3	4	5	6	7	8	9	10	11	12
GIVEN												
RECEIVED (TARGET)												
APPROPRIATE												
INAPPROPRIATE												
HIGH-LEVEL ELABORATION												
LOW-LEVEL ELABORATION												
TIMELY												
UNDERSTOOD BY TARGET												
TARGET USES HELP												

Abbreviations for Coding Behaviors Related to Requests and Responses

WI = Works independently.

L = Looks at peer's work independently for help or information.

AT = Approaches teacher. (detail)

C/F = Shows confusion/frustration.

Rq = Makes a request. (detail)

RPRq = Repeats a request. (detail)

Rqr = Revises a request. (detail)

NRp = No response received to a child's request.

AS = Answers self.

OT = Off task.

RJH = Rejects help from a peer.

RRp = Receives a response to a request. (detail)

UH = Uses (or 'acts on') help received.

IRq = Ignores a peer's request.

GRp = Gives response to a peer. (detail)

OH = Offers unsolicited help.

DPW = Does peer's work <u>for</u> her/him without an accompanying explanation.

	1		2		3		4
L	Rq NR	OT	Rqr	RRp			UH

Above is an example of a time line in minute units with coding done to show sequence of behaviors related to requesting, giving and receiving help.

APPENDIX E

TABLES 1 - 22

Table 1. Total Time of Engagement for General Behaviors Summed across Tasks and Children

Behavior	Total Time in Minutes
Independent Work	317
Group Discussion	154
Cooperative Problem Solving	147
Waiting for Peers	28
Off Task	50

Table 2. Frequencies for General Behaviors Summed across Tasks and Children

Behavior	Total Frequency
Approaches Teacher	122
Looks at Peer's Work	24
Offers Help	68
Rejects Help	9
Requests	322
Responds	187

Table 3. Frequencies for Request Categories Summed across Tasks and Children

Request Categories		Total Frequency
*Level		
	High	123
	Low	137
	C/F	62
*Form		
	Direct	31
	Indirect	291
*Designated		
	Yes	172
	Non-Desig.	150
Revised		
	Aggravated	6
	Mitigated	17
Repeated		26
*Received Response		
	Yes	187
	No	120
	Answered Self	15

* = Category frequencies summed = 322 (total requests).

Table 4. Frequencies for Request Categories Summed across Children and Days

	Designated	Non-Desig.	T	Form: Direct	Form: Indirect	T
Request Level						
High	70	53	123	29	94	123
Low	102	35	137	2	135	137
C/F*	-	62	62	-	62	62
T	172	150	322	31	291	322

* C/F = Confused/Frustrated-type requests.
T = Total

Table 5. Frequencies for Revised & Repeated Request Categories by Request Level

	Revised			Repeated
	Aggravated	Mitigated	T	
Request Level				
High	4	9	13	15
Low	1	7	8	9
C/F*	1	1	2	2
T	6	17	23	26

* C/F = Confused/Frustrated-type requests.
T = Total

Table 6. Frequencies for Response Categories Summed across Tasks and Children

Response Categories		Total Frequency
*Level		
	High	65
	Low	83
	Irrelevant	39
*Appropriate		
	Yes	144
	No	40
	N/A	3
*Timely		
	Yes	181
	No	6
Refusals		12
*Understood		
	Yes	113
	No	33
	N/A	41
*Used Help		
	Yes	103
	No	38
	N/A	46

* = Category frequencies summed = 187 (total responses).

Table 7. Frequencies for Response Categories Summed across Children and Days

	Appropriate				Timely		
	Yes	No	N/A	T	Yes	No	T
Response Level							
High	64	1	-	65	64	1	65
Low	79	4	-	83	81	2	83
Irrelevant	1	35	3	39	36	3	39
T	144	40	3	187	181	6	187

N/A = Not Applicable
T = Total

Table 8. Frequencies for Understood & Used Help Response Categories (Requestor) by Response Level

	Understood				Used Help			
	Yes	No	N/A	T	Yes	No	N/A	T
Response Level								
High	44	21	-	65	44	21	-	65
Low	69	12	2	83	59	17	7	83
Irrelevant	-	-	39	39	-	-	39	39
T	113	33	41	187	103	38	46	187

N/A = Not Applicable
T = Total

Table 9. Frequency of Requesting and Responding as a Function of Day

Day	Total Requests	Total Responses
1	23	21
2	45	31
3	69	32
4	47	24
5	34	16
6	42	26
7	44	25
8	20	12

Table 10. Percents and Frequencies (in parens.) for Request Categories as a Function of Response/No Response

Request Categories	Response	No Response
*Level		
High	60% (69)	40% (46)
Low	79%(102)	22% (28)
C/F	26% (16)	74% (46)
*Form		
Direct	17% (5)	83% (24)
Indirect	65%(182)	35% (96)
*Designated		
Yes	86%(143)	14% (24)
Non-Desig.	31% (44)	69% (96)
Revised		
Aggravated	50% (3)	50% (3)
Mitigated	88% (14)	13% (2)
Repeated	35% (9)	65% (17)

* Category frequencies summed = 322 (total requests).

Table 11. Frequencies for Level of Request as a Function of Level of Response

Request Level	Response Level		
	High	Low	Irrelevant
High	54% (37)	16% (11)	30% (21)
Low	17% (17)	69% (70)	15% (15)
C/F	69% (11)	13% (2)	19% (3)

Table 12. Percents and Frequencies (in parens.) for Request Categories as a Function of Response Appropriateness

Request Categories	Appropriate	Inappropriate	N/A
*Level			
High	67% (46)	29% (20)	4%(3)
Low	83% (85)	17% (17)	(-)
C/F	81% (13)	19% (3)	(-)
*Form			
Direct	20% (1)	40% (2)	40%(2)
Indirect	79%(143)	21% (38)	1%(1)
*Designated			
Yes	76%(108)	24% (34)	1%(1)
Non-Desig.	82% (36)	14% (6)	5%(2)
Revised			
Aggravated	33% (1)	67% (2)	(-)
Mitigated	86% (12)	14% (2)	(-)
Repeated	22% (2)	78% (7)	(-)

N/A = Not Applicable
* = Category frequencies summed = 322 (total requests).

Table 13. Frequencies for Response Level as a Function of Understanding (Requestor) across Tasks & Children

Response Level	Understood		
	Yes	No	N/A
High	44	21	-
Low	69	12	2
Irrelevant	-	-	39

N/A = Not Applicable

Table 14. Total Time of Involvement for General Behaviors Summed across Children by Task

Behavior	Time in Minutes Worksheets	Word Problems	Total
Independent Work	278	39	317
Group Discussion	5	149	154
Cooperative Problem Solving	13	133	147
Waiting for Peers	7	21	28
Off Task	18	32	50

Table 15. Differences Between Means of WS & WP Tasks for General Behaviors Averaged by Child and by Day

Behavior	Mean		t value	p
	Task A (Worksheets)	Task B (Word Prob.)		
Independent Work	9.91	3.27	7.11	<.001
Group Discussion	0.18	5.31	-12.41	<.001
Coop. Problem Solving	0.47	4.77	-35.36	<.001
Waiting for Peers	0.25	0.73	-1.85	<.114
Off Task	0.64	1.13	-2.09	<.082

Table 16. Frequencies for General Behaviors Summed across Children by Task

Behavior	Frequency		
	Worksheets Task	Word Problems Task	Total
Approaches Teacher	96	26	122
Looks at Peer's Work	10	4	24
Offers Help	43	25	68
Rejects Help	4	3	7
Requests	246	76	322
Responds	138	49	187

Table 17. Differences Between Means of WS & WP Tasks for General Behaviors (Frequencies) Averaged by Child and by Day

Behavior	Mean		t value	p
	Task A (Worksheets)	Task B (Word Prob.)		
Approaches Teacher	3.43	.93	8.10	<.001
Looks at Peer's Work	.68	.18	2.10	<.080
Offers Help	1.54	.89	1.27	<.251
Rejects Help	.14	.18	-.26	<.805
Requests	8.86	2.71	5.74	<.001
Responds	4.93	1.75	4.20	<.010

Table 18. Percents and Frequencies (in parens.) for Request Categories Summed across Children by Task

Request Categories	Worksheets Task n=246	Word Problems Task n=76
*Level		
High	42% (105)	24% (18)
Low	39% (97)	53% (40)
C/F	19% (44)	24% (18)
*Form		
Direct	13% (33)	(-)
Indirect	87% (213)	100% (76)
*Designated		
Yes	54% (134)	51% (39)
Non-Desig.	46% (112)	49% (37)
Revised		
Aggravated	29% (6)	(-)
Mitigated	71% (15)	100% (2)
Repeated	(23)	(3)
*Received Response		
Yes	56% (138)	65% (49)
No	78% (94)	22% (26)
Answered Self	93% (14)	7% (1)

* = Category frequencies summed = 322 (total requests)

Table 19. Percents and Frequencies (in parens.) for Response Categories Summed across Children by Task

Response Categories	Frequency		Total
	Worksheets n=138	Word Problems n=49	
*Level			
High	33% (46)	39% (19)	65
Low	42% (58)	51% (25)	83
Irrelevant	25% (34)	10% (5)	39
*Appropriate			
Yes	73% (101)	88% (43)	144
No	25% (34)	12% (6)	40
N/A	2% (3)	(-)	3
*Timely			
Yes	87% (120)	92% (45)	165
No	4% (5)	2% (1)	6
N/A	9% (13)	6% (3)	16
Refusals	8% (11)	2% (1)	12
*Understood			
Yes	59% (81)	65% (32)	113
No	15% (21)	25% (12)	33
N/A	26% (36)	10% (5)	41
*Used Help			
Yes	54% (75)	57% (28)	105
No	17% (23)	31% (15)	38
N/A	29% (40)	12% (6)	46

* = Category frequencies summed = 187 (total responses).

Table 20. Children's Pretest and Posttest Scores by Tasks.

Child ID	Worksheets Task		Word Problems Task	
	pretest	posttest	pretest	posttest
1	71	77	40	40
2	82	80	60	60
3	86	90	40	80
4	68	93	60	80
5	86	93	60	100
6	57	70	60	60
7	82	90	60	100

Table 21. Comparison of Means of Pretest and Posttest Scores by Tasks.

Task	Mean		t value	p
	pretest	posttest		
Worksheets	76.0	84.7	2.72	n.s.
Word Problems	54.3	74.3	2.65	n.s.

Table 22. Comparison of Gain Scores Between Tasks

Mean Difference		t value	p
Worksheets	Word Problems		
8.7	20.0	1.39	n.s.

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