OPTIMIZING GROUPING PRACTICES IN ELEMENTARY CLASSROOMS

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PROEFSCHRIFT

ter verkrijging van
de graad van doctor aan de Universiteit Twente,
op gezag van de rector magnificus,
prof. dr. W.H.M Zijm,
volgens besluit van het College voor Promoties
in het openbaar te verdedigen
op donderdag 8 september 2005 om 13:15

door

Mohammad Ahmad Saleh

geboren op 7 januari 1967
te Kuwait

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Acknowledgments

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Chapter one

Introduction

1.1 Small-group learning

Groups appear to be a functional necessity of all aspects of our lives including work, politics, religion, and education. In schools, pupils are grouped in some form or another. These groupings can be characterized as between-class and within-class groupings. The former refers to the assignment of students to classes based on general characteristics such as age, intelligence, achievement or aptitude. Within-class grouping, in contrast, pertains to the formation and use of small-groups within existing classrooms, usually for didactical purposes and, as a result, often using achievement as grouping dimension. This type of groupings is central to the work presented in this thesis.

Small-group learning is a recommended feature of the approach to science teaching in UK elementary schools. In a survey of second and fifth grade in 111 elementary classroom, Blatchford, Kutnick, and Baines (1999) found that 34% of the teaching in science involved students working in groups. Others have found that group work can add value to the learning process (e.g., Howe & Tolmie, 2003). However, it should be emphasized that small-group learning involves more than just placing students in groups and asking them to work together. While such unstructured groups may provide a natural incentive for students to communicate, it is not mere production of talk that makes small-group learning effective. Rather, its efficacy seems to hinge on instructional measures that encourage active student participation, increase opportunities for student talk and stimulate interaction and processing of information, and for students to share ideas.

Cooperative learning and collaborative learning are two of the most well-known instructional approaches which use small-groups to facilitate student learning. Although numerous attempts have been made to differentiate these

approaches, probably the only acknowledged conclusion is that many of the elements of cooperative learning may be used in collaborative situations and vice versa. This can be seen from the definitions of each approach. Cooperative learning is the strategy in which "*students' work together to accomplish shared goals. Students are assigned to small groups and instructed to learn the assigned material and make sure that the other members of their group learn the assigned material*" (Johnson, Johnson, & Holubec, 1993, p. 4).

Collaborative learning as Dillenbourg (1999, p. 2) defines it is "*a situation in which two or more people learn or attempt to learn something together.*

- *"Two or more" may be interpreted as a pair, a small group (3-5 subjects), a class (20-30), a community (a few hundreds or thousands of people), a society (several thousands or millions of people).*

- *"Learn something" may be interpreted as: follow a course, study course materials, perform learning activities such as problem solving, learn from lifelong work practice, etc.*

- *"Together" may be interpreted as different forms interactions: face-to-face or computer-mediated, synchronous or not, frequent in time or not, whether it is a truly joint effort or whether the labour is divided in a systematic way."*

Thus, both instructional approaches involve students working together in groups and helping each other learn the materials. Their main difference pertains to the type of working arrangement between member of the group (Dillenbourg, 1999; Veerman, 2000). During collaborative learning, students are encouraged to talk and discuss information which may lead facilitate the joint construction of knowledge. Students thus work together on the same task to reach a common goal, exchange ideas, and share the same tools. Cooperative learning is generally characterized by a division of tasks and responsibilities. Each group member works individually on his/her assigned part of the task. Individual solutions are taken as-is, and are merged into a joint product or solution without further discussion. The focus of this thesis is on collaborative learning in elementary classrooms. Using Dillenbourg's (1999) definition, collaborative learning in this thesis denotes a situation in which four to

five students work together in a face-to-face setting to perform learning activities to improve their understanding of a subject.

1.2 Research questions

Within the context of collaborative, small-group learning, the main focus of the current research is on grouping practices: the ways in which teachers can divide students into learning groups. As groups can be of different sizes and compositions, teachers have a wide range of options to form groups. However, since the size of a small learning group was defined as four to five students, the research primarily addresses group composition.

Empirical research on learning in collaborative learning groups has shown that the composition of the group in terms of ability, gender, and ethnic background influences group processes and student learning (Webb, 1995). The work reported here seeks to replicate and extend this line of research by examining the following main questions:

1. *How does within-class grouping affect learning?*
2. *How can within-class grouping be improved to maximize the potential of collaborative learning for all students?*

1.3 Research context

The studies that are reported in this thesis have been conducted in elementary schools in the State of Kuwait. In order to contextualize these studies, a brief description of the education system in Kuwait is given.

Education in Kuwait is managed and operated by the Ministry of Education, which sets the goals and objectives for the entire education system. The Ministry is headed by an official who has power in most of the decision-making processes regarding education in Kuwait. This authority is based on the centralization policy that the ministry believes in, a common policy in the political philosophy of the government.

The Ministry of Education has divided the country into a number of education districts or zones. Each district has a director and a directorate of education which is a smaller copy in its organization of the central ministry. The director is in charge of all education activities in his jurisdiction, but he usually has very little power or freedom of action. He mainly implements the policies, regulations, and orders of the central Ministry and reports on local problems. Moreover, each of the education directorates has its private supervision department, which is responsible for the teaching methods and the examination quality in schools.

The structure of the education system in Kuwait follows a 2-4-4-4 model: two years for kindergarten (4-6 years old), four years for the elementary level (6-10 years old), four years for the intermediate level (10-14 years old), and four years for the secondary level (14-18 years old). Boys and girls are studying in separate school buildings. There is no distinction between the students with regard to ethnicity. The number of the students in government schools is maximum 30 students per class.

Each school has a computer lab and science laboratories that include all the facilities needed to learn science subject (such as, TV, video, pictures, special tables, chemical and physical materials). The classrooms are formally arranged with individual desks in rows facing the blackboard.

With regard to the teaching methods in Kuwait schools, the emphasis is still on whole-class instruction and individual learning (Al-Aryan & Al-Abduljader, 1998). Other studies have found that "traditional" teaching methods still prevail in Kuwait schools. Al-Ahmad, (1986) surveyed the teaching methods used in Kuwait by 208 male and 108 female teachers in 24 schools. He found that the lecturing was the most common teaching method. Al-Sharah and Al-Khabbas (1987) also studied teaching methods in Kuwait, and observed that all public schools and curricula advocated the use of individual learning strategies. Individual learning strategies give students opportunities to complete learning tasks on their own, without any help from other students. Johnson et al. (1993) characterized these strategies as follows: "*Students' work by themselves to accomplish learning goals unrelated to those of other students. Individual goals are assigned each day, students' efforts are evaluated on a fixed set of standards, and rewards are given accordingly. Each student has a set of materials and works at his or her own speed, ignoring the other*

students in the class. In individualistic learning situations, students' goal achievement is independent; students perceive that the achievement of their learning goals is unrelated to what other students do" (p. 3).

Around the turn of the century, a discussion on the use of teaching and learning methods has started to emerge in Kuwait. Al-Aryan and Al-Abduljader (1998) argued that a problem in academic achievement is being caused by the content of curriculum and teaching methods. More specifically, they claimed that the curriculum did not enable students to acquire thinking skills because of its emphasis on individualistic learning strategies. Prompted by these notions, educational research in Kuwait has begun to study the efficacy of utilizing collaborative learning strategies.

Although a number of empirical studies in classroom settings have shown positive effects of collaborative learning (e.g., Lou et al., 1996), this instructional strategy has been ignored in Kuwait education. The reasons for this neglect may be twofold (Khaled, 1999). On the one hand, the negative attitude toward collaborative learning may have been caused by a lack of experience with this form of learning. On the other hand, academic studies into collaborative learning by the Ministry of Education have yielded discouraging results.

Five studies have been conducted to utilizing collaborative learning by the Ministry of Education in Kuwait (Khaled, 1999). The results of these studies have not been encouraging for several reasons. First, the teachers were not familiar with collaborative learning and they did not receive any training before using this strategy. Second, the teachers did not take social interaction into consideration once applying this strategy. Third, all studies applied collaborative learning for a limited period of time (i.e., one or two weeks). Fourth, the introductory training to familiarize students with collaborative learning was too short (i.e., one lesson). Finally, the pervasive and sustained use of traditional teaching methods might have made it difficult to transform student into true "collaborative learners" overnight.

These limitations signal important implications for the present research. These pertain to the familiarization of teachers with collaborative learning and the role of social interaction in small-group learning as well as methodological issues concerning the duration of the introductory training and the actual study. Therefore,

prior to examining the effects of within-class grouping, a preliminary test of the efficacy of collaborative learning in Kuwait was performed, taking into account these implications.

To anticipate potential detrimental effects of students' experience with traditional teaching and learning methods, elementary students (boys between the ages of 9 and 10) have been chosen as participants in the experiments. The choice for this target audience was motivated by the presupposition that young children have grown least accustomed to traditional modes of teaching and learning. They were thus presumed to adapt more easily to collaborative learning than students who have receive more years of education. This is particularly important in view of the relatively short time span during which experimental investigations are usually being conducted.

1.4 Overview of the thesis

This thesis contains seven Chapters. Following the problem definition that was given in this introductory Chapter, Chapter 2 outlines theoretical and empirical evidence on the educational advantages of collaborative learning. The Chapter also addresses the effects of group composition and reviews instructional measures that may further enhance the quality of learning in small groups. Chapter 3 gives a detailed account of the general collaborative learning method that was used in the empirical studies. This method was adapted from Slavin's (1994) Student Team Achievement Division, and was tailored to the idiosyncrasies of the educational setting at hand.

The empirical study reported in Chapter 4 aimed to assess the benefits of collaborative learning over individual learning. As explained above, this assessment was deemed necessary because of the negative experiences with collaborative learning in Kuwait schools. This study also served as a pilot test of the materials, methods and procedures for collaborative learning that were outlined in Chapter 3.

The studies in Chapters 5 and 6 sought to answer the central research questions. In Chapter 5, the effects of within-class grouping were examined. Given the fact that Kuwait elementary schools contain same-gender, same-ethnicity

classes, this study focused on within-class ability grouping. More specifically, it examined the effects of working in heterogeneous and homogeneous grouping on verbal interaction, learning, and motivation. The study presented in Chapter 6 examined whether and how scripted collaboration can maximize learning in homogeneous and heterogeneous ability groups. Chapter 7 presents a synthesis of the findings and discusses their implications for further research and educational practice.

Chapter two

Theoretical Framework

Abstract

The aim of this Chapter is to provide a description of relevant theories and empirical research on collaborative learning. More specifically, the Chapter outlines four conditions for successful collaborative learning: positive interdependence, individual accountability, training in social skills, and promotive social interaction. The Chapter also proposes three strategies to promote social interaction during collaborative learning. These strategies pertain to the composition of the learning group, ground rules for talk and role assignment to regulate students' participation in the group interaction.

2.1 Introduction

Collaborative learning has become a widely accepted way of teaching and learning. Its use has spread across all levels of schooling and many subject areas. In addition, there is a growing consensus among researchers about the positive effects of collaborative learning on student achievement (Dillenbourg, 1999; Johnson & Johnson, 1999; Lazarowitz & Karsenty, 1990; Okebukola & Ogunniyi, 1984; Sharan & Shaulov, 1990; Slavin, 1996; Webb, 1989). The potential of collaborative learning was shown in meta-analytical studies comparing collaborative learning with whole-class instruction or individual learning (e.g., Cohen, 1994; Lou et al., 1996). These studies report substantial facilitative effects of collaborative learning on both group task performance and achievement on individual posttests. Additionally, these effects appear to be relatively independent of group size, student age, and ability.

However, the attempts to introduce collaborative learning in Kuwait schools have shown that simply placing students in a group and assigning them a task does

not guarantee that students will gain higher learning outcomes (Khaled, 1999; see also Carrier & Sales, 1987; Klein, Erchul, & Pridemore, 1994). This raises the question of which basic requirements should be met for collaborative learning to be effective. In order to answer this question, conditions for successful collaborative learning are described in Section 2. These conditions will guide the design of the collaborative learning method used in the empirical studies. A second related question concerns additional measures that might further improve the quality of collaborative learning. Section 3 proposes three potentially effective strategies, all of which pertain to the shaping of social interaction during small group learning.

2.2 Conditions for collaborative learning

Merely placing students in groups does not guarantee that collaboration will occur. Rather, groupwork needs to be structured so that students understand how they are expected to work together. According to Gillies (2003), this includes ensuring that the following requirements are met: positive interdependence, individual accountability, training in social skills, and promotive social interaction (see also Johnson & Johnson, 1990).

2.2.1 Positive interdependence and individual accountability

The structuring of positive interdependence and individual accountability can be considered the most important elements related to the effectiveness of collaborative learning (Slavin, 1996). Interdependence exists when the efforts of one group member do not make the efforts of the other group member unnecessary. *Positive* interdependence refers to the perception that "you are linked with others in such a way that you cannot succeed unless they do, and that their work benefits you and your work benefits them" (Johnson & Johnson, 1999, p. 58). Positive interdependence needs to be structured to ensure that one member's efforts do not make the efforts of other members unnecessary, so there can be no "free riders" (Kerr, 1983). To do so each student should be held individually responsible and accountable for doing his or her share of the work and for learning what has been targeted to be learned. Knight and Bohlmeyer (1990) asserted that the essential

elements for collaborative learning to have a positive effect on academic achievement is individual accountability. Fantuzzo et al. (1992) found greater achievement for collaborative learning using individual accountability than for those that do not.

Individual accountability exists when the performance of each individual student is assessed and the results are given back to the individual and the group, who holds each person responsible for contributing a fair share to the group's success (Johnson & Johnson, 1999, p. 58). The importance of individual accountability is in pushing the students to help and encourage each other to learn the materials (Slavin, 1995). In this way group members will be motivated to help each other to make sure that everyone has learned the content. A lack of individual accountability may tend to make one or more group members sit back and let others do the work – a phenomenon known as "social loafing" (Karau & Williams, 1993).

Individual accountability can be structured in several ways. In the Students Team Learning methods (Slavin, 1994), groups are rewarded based on the sum of their members' individual quiz scores or other individual performances. Another way to structure individual accountability is to randomly select one student to present the work of the group or having each student explain what he has learned from a classmate (Johnson & Johnson, 1999).

2.2.2 Social skills

Effective collaborative learning also requires social skills. Various social skills have been identified that promote small-group learning. These include listening to each other, acknowledging each others' ideas, taking turns, and resolving conflicts democratically (Gillies, 2003). Students must not only be taught these skills, they should also be given the opportunity to practice their use in authentic collaborative learning situations. This was demonstrated by Gillies and Ashman (1996), who compared students from untrained collaborative learning groups with students from groups that received social skills training. They found that children in the trained groups achieved higher learning outcomes, were more cooperative and helpful to

each other, and had a more positive perception of the groups as a social and safe environment.

2.2.3 Promotive social interaction

Social interaction refers to the task-related verbalizations during small-group learning; as not all task-related utterances are equally beneficial to learning the term *promotive* social interaction is used to indicate task-related verbalizations that are positively associated with learning.

Social interaction plays a pivotal role in collaborative learning. According to the theory of cognitive effects of social interaction, knowledge is socially constructed and social interaction is necessary for children to learn (Vygotsky, 1978). Various studies have demonstrated that participating in group discussions facilitates small-group learning (Johnson & Johnson, 1989; Spurlin et al., 1984; Webb, 1989). In all of these studies, engaging in elaborated verbal behavior was associated with high learning outcomes. Cohen (1994) further asserted that the failure of students to participate in the interactions of a group is linked to negative achievement outcomes.

Social cognitive theories of learning suggest two reasons why content-related verbalizations promote learning. Rooted in Vygotskian and Piagetian ideas, these theories assume that verbal interaction during small-group learning leads to peer elaborations. A second interpretation that follows from social cognitive theories is that group interaction is a stimulating force in the co-construction of knowledge. Both perspectives are detailed below.

Peer elaboration

The first interpretation dwells on the notion that collaborative learning stimulates peer elaboration. Webb and Mastergeorge (2003) defined an elaboration as a cognitive process that takes place within one individual's thinking as a result of interaction with other group members. Elaborations can be stimulated by three kinds of verbal activities: asking and answering questions, reasoning, and solving cognitive conflicts.

Asking and answering questions by group members is the first way to stimulate elaborations. King (1994) utilized questioning as a learning strategy through which pairs of students can help each other in processing new information. King found that requiring students to ask thought-provoking questions promotes high level discussion, which in turn results in high level learning. That is, the question stimulates elaborated explanation, which can positively influence the performance of both the student receiving the explanation and the students providing it.

Webb has studied asking and answering of questions in heterogeneous ability groups. Her work starts from the notion that children are often more aware than their teachers of what other children do not understand and will often provide explanations to them in a way that can correct their misconceptions (Webb & Farivar, 1994). By receiving explanations, the less knowledgeable student can correct misconceptions and fill in gap in his understanding (Wittrock, 1990). The explainer benefits from the cognitive restructuring involved in peer elaboration in that it might trigger the detection and repair of misconceptions and knowledge gaps (Webb & Palinscar, 1996). On the other hand, students who do not ask for help when they need it may never correct misconception or lack of understanding (Webb, 1995).

Reasoning is another way to stimulate elaborations. It refers to a situation in which elaborated discussions occur spontaneously, without being prompted by a request for help or explanation. Such discussions arise because group members have to make their thoughts explicit in order to understand each other. Reasoning episodes often start with one or more students expressing some claims. Other students may then provide arguments for these claims or relate the claims to other knowledge or experiences. Similar to asking and answering of questions, the elaborated verbalizations that occur during reasoning may encourage students to consider, and possibly improve their own understanding.

Cognitive conflicts are a third way to stimulate elaborations. According to Piaget (1926), students can experience a conflict between their own ideas and ideas of others and, in order to resolve this cognitive conflict, the students must explain their viewpoints to each other. Students reaction can vary from not believing the new information to a radical change of thinking (Chinn & Brewer, 1993). The effect

of this discrepancy leads the learner to re-examine his own ideas and beliefs, to ask for more information to resolve the conflicting viewpoints, and to try out new ideas (De Lisi & Golbeck, 1999; Gijlers & De Jong, 2005).

Co-construction of knowledge

The second interpretation emphasizes the role of social interaction in the joint construction of knowledge. According to this view, knowledge is being co-constructed by group members on the basis of equal partnership. When students collaborate as equals, exercise mutual control over the interaction, and share each other's point of view, peer interaction generally facilitates learning (Piaget, 1976).

Students construct a shared understanding of a given topic by building on each other's ideas, discussing the significance of personal beliefs until mutual agreement is reached (Damon & Phelps, 1989; Slavin, 1995). This process figures prominently in the constructivist perspective of Vygotsky (1978) in which interactions with others can internalize knowledge, meanings, and skills and collaboratively build new knowledge and insights. Developing new understanding by building on other students ideas is a form of learning that students can demonstrate on subsequent individual learning. Building on each other ideas can also help the group produce a higher quality product or solution to a problem (Webb, 1995).

Co-constructions are, just like peer elaborations, stimulated by asking and answering questions, reasoning, and solving conflicts during group discussion. Despite the fact that both processes are elicited by the same kinds of verbal behavior, they differ in focus. Peer elaboration pertains to the individual knowledge construction that results from group interaction, whereas co-construction focuses on the way in which a group of students interacts to come to a shared understanding of the subject matter. While this distinction may be valid from a theoretical point of view, the lines often blur in practice. It was therefore deemed more appropriate to take a pragmatic stance and, consistent with Van Boxtel (2000), consider co-construction as a special case of peer elaboration, namely a collaborative elaboration.

2.3 Strategies for promoting social interaction

Although the above conditions establish the basic requirements for promotive social interaction to occur, the possibilities for students to engage in productive learning dialogues may be further enhanced by the use of certain strategies. Three strategies were central to the work reported in this thesis. They pertain to the composition of the learning group, ground rules for talk, and role assignment to regulate students' participation in the group interaction.

2.3.1 Group composition

Discussions on grouping arrangements generally center on the issue of whether groups should be homogeneous or heterogeneous in terms of student ability, gender, and ethnicity. As was mentioned in Chapter 1, Kuwait elementary school contain same-gender, same-ethnicity classes. This narrows down the choice of student characteristics in group composition to their ability level, which is often assessed from their prior achievement.

If groups are formed on the basis of student ability, there are essentially two possibilities: groups can be composed of students who are either similar or dissimilar in ability. It is commonly believed that the nature of the students' interactions differs as a function of the composition of their learning group. In keeping with the perspectives of social interaction discussed in the previous section, students in heterogeneous ability groups are assumed to show relatively high proportions of peer elaborations. Homogeneous ability groups, in contrast, will presumably yield relatively more instances of co-construction.

While prior research has addressed the issues underlying these hypotheses, empirical evidence tends to be incomplete. The interactions among students of high and low ability are relatively well documented in the research literature (Azmitia, 1988; Hooper & Hannafin, 1991; Lou et al., 1996). These studies have shown that heterogeneous groups benefit low-ability students by giving them access to the intellectual resources of their more capable group members. Webb (1991) has characterized the nature of the interaction as a teacher-learner relationship, with the

low-ability students asking questions and the high-ability students giving help and explanations. Consistent with the notions of peer elaboration, these interactions caused both types of students to learn more in heterogeneous groups than in homogeneous groups.

Research on average-ability students is scant. Webb (1989) suggested that average-ability students in heterogeneous groups do not take the advantage of collaborative learning because they are excluded from teacher-learner relationships that develop between highs and lows and are given few opportunities to participate. Webb (1991) showed that average-ability students learn more in homogeneous groups because they receive more explanations than their heterogeneously grouped counterparts. This seems at odds with the assumption that same-ability students (predominantly) co-construct knowledge by discussing the subject matter on the basis of equal partnership. Prompted by this seeming inconsistency, the relationship between ability grouping and social interaction was examined in the study reported in Chapter 5.

2.3.2 Ground rules for talk

While ability-grouping arrangements affect the general nature of the group interaction, it does not promote students' interaction skills per se. Yet research has shown that elementary school students do not naturally know how to participate effectively in group discussions (e.g., Fuchs et al., 1994; Palinscar & Brown, 1984). Providing ground rules for talk might be an effective way to enhance the educational value of students' interactions (Mercer et al., 1999).

Ground rules are defined as guidelines to encourage the use of promotive social interactions and behaviors (Sandelin, n.d.). As both peer elaborations and co-constructions are elicited by the same kinds of interaction skills (asking and answering of questions, reasoning, and conflict resolution), these skills should be addressed by the ground rules.

Ground rules can be presented in various ways. One possibility is to give students a preparatory training in the use of the ground rules (Johnson & Johnson, 1994). One of the most well-known examples is King's (1994) guided collaborative

questioning method. This approach includes activities such as asking thought-provoking questions, integrating new knowledge with prior knowledge, and examining alternative perspectives has positive effects on interaction and learning. Various studies have demonstrated that children's interactions can be enhanced when promotive interaction skills are trained. Gillies (2004) found that children who worked in trained collaboration groups (i.e., received social interaction training) were more collaborative and helpful to each other than children who worked in untrained collaboration groups. Mercer et al. (1999) found that teaching students productive interactions helps them to work more effectively together on tasks. Similar effects were reported by Swing and Peterson (1982), who taught students social interaction skills and explaining skills to improve their ability to help other students in their learning group.

Webb and Farivar (1994) adapted many of the principles of Swing and Peterson's program. In addition, they used charts of behaviors for students to engage in when they did not understand how to solve a problem (e.g., asking clear and precise questions). These charts contained the ground rules for promotive social interaction. In their study, participants received an introductory training on the use of these ground rules. During the experiment, each group was given prompt cards on which the ground rules for asking for/providing explanation and other help were listed. Webb and Farivar found that students from the trained condition gave and received more elaborations and performed better on the individual posttest than untrained students.

2.3.3 Group roles

Teaching students the skills needed for collaboration is important for stimulating students to participate in group discussion. It may be equally important to create opportunities for students to put acquired skills into practice. Even so, there is reason to believe that group composition affects the degree to which students participate in the group interaction. For example, in heterogeneous ability groups, high-ability students have more opportunities to talk, answer questions, and control discussion. Low-ability students often say little and ask most questions, whereas the

participation of average-ability students may be even lower because they tend to be excluded from the teacher-learner dialogues between high and low-ability students (Webb, 1989).

Assigning students to different roles during collaborative learning is a potentially fruitful way to regulate their participation in the group interaction. Kagan (1992) found that assigning roles (such as: listening, summarizing, and encouraging) for students to play equalizes their participation in the interaction. The benefits of roles appear from its definition. Hare (1994) defined roles as more or less stated functions, duties, or responsibilities that guide individual behavior and regulate intragroup interaction. Roles can also be used to foster positive interdependence and individual accountability (Brush, 1998).

One of the most well-known instructional approaches which used roles to facilitate students' participation is scripted collaboration. This structure was developed by O'Donnell and Dansereau (1992) and was called the "MURDER" script – an acronym for the activities students had to perform. Students in this method take roles as recaller and listener. They read a section of text, and then the recaller summarizes the information while the listener provides feedback without looking at the text. On the next section, students switch roles. O'Donnell and Dansereau found that students working on scripted collaboration outperformed those who worked on unscripted collaboration. Other studies have shown that alternating roles is more effective than using fixed roles (Spurlin, Larson, Dansereau, & Brooks, 1985), which may be due to the fact that students remember more information from the text passages they process as recaller than as listener (Lambiotte et al., 1987).

Another instructional approach using group roles is "reciprocal teaching." This structure was developed by Palincsar and Brown (1984). They provided learners with a structure for comprehending text material in small groups. This structure contains several activities in a specific sequence, which are modeled by the teacher. These activities include specific text comprehension fostering strategies that the learners are expected to apply, namely questioning, summarizing, clarifying, and predicting. First, learners read the beginning section of a text. Subsequently, one learner takes the role of the teacher. The learner's task is to ask questions on the text

that should be answered by another learner. Then, the student in the teacher role tries to summarize the main ideas of the text. If necessary the learning partner completes missing subjects. Thereafter the 'teacher' identifies difficult passages of the text and tries to clear them up in collaboration with the learning partner. Finally, all learners try to predict the contents of the following text passages. Learners change teacher and learner roles for following text passages in order to assure equal involvement of all learners in collaborative knowledge construction.

Palinscar and Brown (1984) report two studies that assessed the efficacy of this approach. Pairs of seventh graders with poor text comprehension skills learned comprehension strategies through either reciprocal teaching or a proven remedial teaching method. Over a twenty-lesson training period, students in reciprocal teaching groups showed a steady increase in text comprehension abilities, whereas students from remedial teaching groups and untrained control groups showed no significant improvement. Reciprocal teaching further yielded significant gains in students' questioning and summarizing skills. A follow-up study showed that these benefits are reliable, durable, and generalize to small-group learning in authentic classroom settings.

2.4 Research implications

This Chapter started from the notion that placing students in groups and telling them to work together does not necessarily promote collaboration and learning. From a review of the literature it appeared that at least three conditions should be satisfied for collaborative learning to be effective. In brief, these conditions imply that group members should feel individually responsible for the group's performance, possess social skills and be able to engage in productive task-related interactions. As this promotive social interaction was considered the key to successful collaborative learning, three strategies were proposed to further improve the quality of students' learning dialogues. These strategies pertain to the composition of the learning group, ground rules for talk and role assignment to regulate students' participation in the group interaction.

These conditions and strategies constitute the theoretical framework for the empirical part of this thesis. From this framework implications can be derived for the assessment of collaborative learning. One apparent implication is that the empirical studies should seek to reveal differences in academic achievement. In view of the current emphasis on social interaction, the studies should go beyond the individual students' knowledge gains by taking the group's task performance into account. This would do justice to the way in which knowledge is assumed to be acquired and the alleged role of social interaction in small-group learning.

A second related implication is that the studies should address social interaction. Data on the nature of the groups' learning dialogues will shed light on the alleged relationship between social interaction and academic achievement. Social interaction should also be assessed to examine the effects of the three strategies that were hypothesized to enhance the quality of students' learning discourse.

However, using different group compositions, assigning students to roles and encouraging them to communicate according to certain ground rules may influence the students' motivational beliefs. Students are generally motivated to learn in groups. Slavin (1984) has argued that a possible factor responsible for the success of collaborative learning is the positive motivational impact of peer support for learning. Collaborative learning creates a situation in which student outcomes are dependent on one another's behavior, which is assumed to motivate students to engage in group work more actively to help the group to become successful. For collaborative learning to have a positive impact on student motivation, both Johnson and Johnson (1994) and Slavin (1995) found that group rewards based on the individual performance of all group members are essential. For example, in Student Teams-Achievement Divisions (Slavin, 1994), groups earn certificates based on the degree to which group members have improved over their individual quiz score.

When used properly, collaborative learning has shown to be effective in increasing students' motivational belief toward learning. Most authors of professional works and research studies on collaborative learning have asserted that small-group learning enhances students' motivation to learn more than the individual learning (e.g., Johnson & Johnson, 1990; Wentzel, 1991; Slavin, 1990).

This facilitative effect is probably due to the social interaction that occurs during group work. Another reason may be that collaborative learning creates equal opportunities for success. Since it is unknown how group composition, group roles and ground rules may affect students' motivational beliefs, this measure needs to be included in the studies.

These implications guided the design of the experimental studies reported in Chapter 4, 5 and 6. These studies aimed to validate the conditions for collaborative learning and explore the effects of the strategies to promote social interaction. The study reported in Chapter 4 compared a course that was organized according to the conditions for effective collaboration to individual learning. Consistent with the above implications, the study examined between-group differences in academic achievement, social interaction, and motivation. The second study assessed the effects of within-class ability grouping. More specifically, this study examined the effects of working in heterogeneous and homogeneous groups on social interaction, academic achievement, and motivation. Based upon the results of this study a third study was designed to investigate the influence of structuring collaboration through role assignment and ground rules. As in the previous studies, dependent measures concerned social interaction, academic achievement, and motivation.

Chapter three

The Collaborative Learning Method

Abstract

To be successful in setting up and having students complete group task within a collaborative learning framework, a number of components or requirements must be met. This chapter gives a detailed account of these components and requirements and the way they are combined into a general collaborative learning method that was used in the empirical studies of this thesis.

3.1 Introduction

Attempts to introduce collaborative learning in Kuwait schools have not yet been able to produce the desired effects (Khaled, 1999). As was pointed out in chapter 1, this may to some extent be due to the fact that both teachers and students are unfamiliar with this way of learning. Especially the teachers' lack of experience may have resulted in insufficient or ineffective structuring and guidance of collaborative learning. In order to anticipate these difficulties, the studies in this thesis utilized a collaborative learning method that was adapted from a set of instructional techniques known as Student Teams-Achievement Divisions or STAD (Slavin, 1994). This method consisted of two phases (Figure 3.1) which are described in the sections below.

3.2 Preparing

The first responsibility taken on by teachers who utilize collaborative learning in their classrooms is to select the desired academic objectives, decide on group size, assign students to groups, and arrange the classroom for group working. If necessary, teachers should train their students in effective collaborative learning skills.

1. Preparing
   a. Selecting academic objectives
   b. Assigning students to groups
   c. Making classroom arrangement
   d. Training
2. Activities and procedures of learning
   a. Teacher presentation
   b. Group work
   c. Group processing
   d. Team recognition
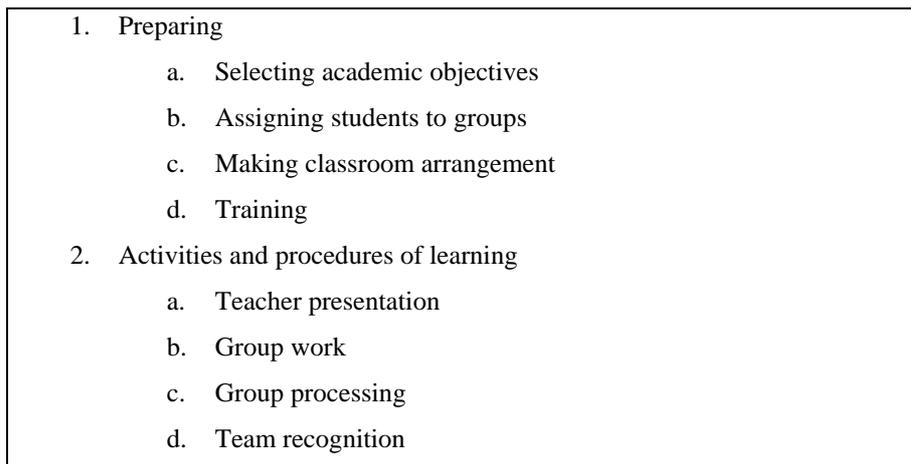
Figure 3.1 General collaborative learning method

3.2.1 Academic objectives

The first step in the collaborative learning method concerns the selection of the course content. A plant biology unit was chosen as the instructional content of the studies reported in this thesis. The majority of the instructional materials were adapted from a fourth-grade science textbook that is used in Kuwait schools. These materials covered basic botanical topics (e.g., the parts of fruit, vegetables and flowers, their life cycle, and the way they store food) as well as advanced issues that were deemed ill-structured and complex to fourth-graders (e.g., growing, preserving and using fruit and vegetables). Table 3.1 presents an overview of the academic objectives for the sixteen plant biology lessons. Their sequencing is shown in Table 3.2.

3.2.2 Assigning students to groups

Having established the instructional content, students were assigned to their learning groups. Since the focus of this thesis is on within-class grouping arrangements, a detailed account of the grouping practices will be given in the method sections of each study (see Chapter 4, 5, and 6). There were, however, several commonalties in these grouping arrangements. For one, all studies utilized small, teacher-assigned groups of 4 or 5 students, which is assumed to be the most efficient group size for

attaining learning goals (Cohen, 1994). Given the focus on within-class groupings, these groups were composed of classmates. Only in cases where a full within-class grouping would conflict with the purposes of a study, students from different fourth-grade classes would be grouped. In all three studies, same-gender groups were formed because boys and girls are studying in separated schools in Kuwait.

Table 3.1

Academic objectives for the plant biology lessons

1. Explain the advantages of plants, such as: food (for both humans and animals), clothing, fuel, and medicines.
2. Discuss that different fruits have different kinds of seeds. Describe and compare the seeds by color, size, shape, and number.
3. Identify different ways of growing plants in addition to seeds: potato, bulb, sapling, and cutting.
4. Explain the procedures to plant a plant using seeds, potato, or bulb.
5. Describe and draw the life cycle of plants.
6. Identify the flower parts: anther, petal, pistil, and sepal.
7. Recognize plant parts: root, stem, leaf, flower, and fruit. Discuss the function of each of them to the plant.
8. Identify root, stem, and leaf systems (as well as measure length and width).
9. Discuss and describe how a plant makes its food? What does it need to make the food (sunlight, water, and air).
10. Identify the place that plant store the redundant food: in roots: carrots and potatoes; stems: celery and asparagus; leaves: lettuce, cabbage, and turnips; flowers: cauliflower and broccoli; and in fruit.
11. Discuss and explain why people need to preserve food? What happens to food outside the refrigerator?
12. Identify the ways to preserve food, such as: cooling and freezing, tinning and bottling, drying, sugaring, and salting.

3.2.3 Classroom arrangement

In order to work collaboratively, the classroom was arranged so that the number of each group was hanging from the ceiling. Students moved their desks to the area

that matches their group number and then arranged themselves so that they were facing each other (see Figure 3.2). Posters displaying the desired social skills were hanging on the classroom wall to help students establish a true collaborative learning climate.
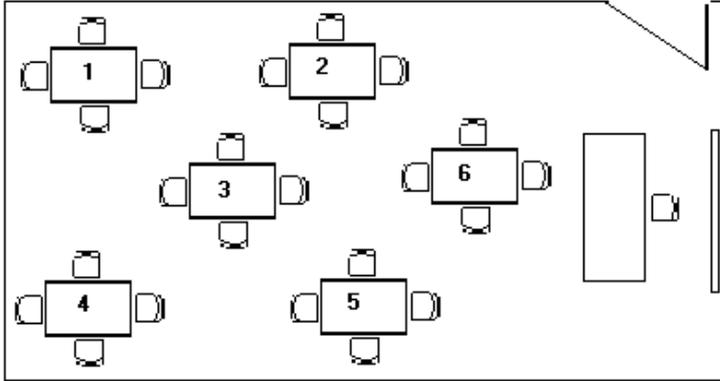
Figure 3.2 Classroom arrangements (numbers represent group numbers)

3.2.4 Training

To help students learn to work effectively in groups, all participants (students and their teacher) carried out activities to develop basic collaborative learning skills. This training was given by the experimenter. Training content concerned animal biology, a topic related but not similar to the plant biology course.

The training was based on the work of Webb and Farivar (1994) and required students to (a) carry out inclusion activities to help them become familiar with their groupmates, (b) create and discuss classroom charts of social skills, and (c) carry out activities designed to develop proficiency in working with others (e.g., listening attentively, not putting down others, using a moderate voice level, and encouraging participation) and engaging in promotive social interaction (e.g., checking for understanding, sharing ideas and information, encouraging others, and checking for agreement).

3.3 Activities and procedures of learning

The second phase of the collaborative learning method comprises the learning and teaching activities. The plant biology unit was divided in sixteen 35-minute lessons, and each lesson was organized according to the procedure outlined below.

3.3.1 Teacher presentation

Each lesson started with a ten-minute presentation by the teacher, describing the objectives of the lesson and explaining the procedures students should follow.

3.3.2 Group work

After the introduction by the teacher, students worked in their learning groups. Their task was to master the content that was presented in the instructional materials and to help their teammates learn this content. An overview of the activities during the lessons is displayed in Table 3.2.

Each group received only one set of materials (e.g., one work-and-answer sheet) and students were told to work together and discuss the answers. This procedure was to create positive interdependence.

Students were also instructed to display concern about each other to assure that *all* group members would understand the lesson content. This feeling of individual accountability was further enhanced by informing students that (a) at the end of each group's work the teacher would randomly select one student from each group to present the group's answers, and (b) they could earn bonus points if they and their partners both achieved better on a quiz that was administered every three lessons (see the section "Team recognition" below).

Once groups were working on their tasks, the teacher would walk around to monitor performance, provide emotional support and encouragement, and encourage the students to collaborate. Students monitoring can be powerful in promoting group reflection (Udvari-Solner, 1994).

Table 3.2

Group work activities

Lesson 1, 2, and 3
1. Teacher presentation
2. Groups filled out a worksheet on identifying the advantages of plants.
3. Groups received various fruits. They named each of these fruits, and examined the seeds inside the fruits to identify differences and similarities in size (big, small, tiny), color (red, brown, green), shape (round, oval), and number (one, a few, lots).
4. Groups made a drawing of a different fruit and its seeds on a poster paper. Then the teacher randomly selected one member from each group to tell the class what they found out about the seeds—color, size, shape, and number.

Lesson 4
    Quiz 1 + group processing + teacher evaluation

Lesson 5, 6 and 7
1. Team recognition + teacher presentation
2. Groups filled out a worksheet on identifying different ways to grow plants. Examples had to be given for each plant.
3. Groups described and drew the life cycle of a plant on a poster paper. The teacher then randomly selected one of the group members to explain the life cycle of plant.
4. Groups identified the following parts of a plant: root, stem, leaf, flower, and fruit, and discussed the function of each part. The teacher discussed these functions with the students after groups work.

Lesson 8
    Quiz 2 + group processing + teacher evaluation
Lesson 9, 10, and 11
1. Team recognition + teacher presentation
2. The teacher gave each group three kinds of roots, stems, and leafs. The groups compared their lengths and widths and wrote the group solution on a worksheet.
3. Groups discussed and described how plants make their own food. They receiving guiding questions such as "What does it need to make the food?" and "Why do we put the plant near the window?" After group work the teacher discussed these questions with the whole class.
Lesson 12
    Quiz 3 + group processing + teacher evaluation

Table 3.2

Continued

Lesson 13, 14, and 15
1. Team recognition + teacher presentation
2. Groups made a table to identify the place where plants store redundant food: in roots (such as…), stems (such as…), leaves (such as…), flowers (such as…), and in fruit (such as…). After groups work each table was put on the classroom wall and was discussed by the teacher.
3. Groups filled out a worksheet on identifying the ways of preserving some kinds of foods with examples on each of them. The teacher randomly selected one member from each group to tell the class what his group found out about the ways of preserving foods.

Lesson 16
        Quiz 4 + group processing + teacher evaluation

3.3.3 Group processing

After group work, the teacher summarized important points and answered remaining questions posed by students. There was also time for both the students and the teacher to evaluate academic achievement and social interaction. Toward this end feedback about the quality of group work was provided, which is deemed important to their progress in developing collaborative skills (Weissglass, 1996). Moreover, it might positively affect students' social interaction (Johnson & Johnson, 1993). Before the lesson ended, students engaged in group processing in which group members discussed and identified what member behavior was supportive and ineffective and to decide which interactions to continue or change.

3.3.4 Team recognition

The use of individual grades in collaborative learning should stress the importance of individual effort and accountability in achieving the group goal (Borich, 2000). Collaborative learning grades therefore incorporated both individual performance and the quality of the group's products. Individual performance was assessed by a quiz, which was administered every three lessons; the group products was readily collected after each lesson. These scores served to assign group awards.

Quiz score (max. = 10)	Bonus Points
From 0 to 4.5 points	0
From 5 to 6 points	2
From 6.5 to 7.5 points	3
From 8 to 9 points	4
From 9 to 10 points	5

Figure 3.3 Rubric for awarding bonus points

Group award scores depended on the number of bonus points earned by the group members. Students could earn up to five bonus points for their group based on their quiz scores. The rubric that was used to assign bonus points is shown in Figure 3.3. Criteria were set so that to be a "Good group" the group bonus points must be at least 10. To qualify as a "Great group", the group bonus points must be at least 15; the "Super group" award was given in case a group had earned at least 20 bonus points. It is important to note that all groups could achieve a particular award. Groups were not competing with one another, so theoretically speaking all groups could simultaneously receive the "Super group" award. Figure 3.4 exemplifies how the teacher used the bonus points to assign group awards.

Group: 5								
	Quiz 1		**Quiz 2**		**Quiz 3**		**Quiz 4**	
Group Members	Quiz Score	Bonus Points	Quiz Score	Bonus Points	Quiz Score	Bonus Points	Quiz Score	Bonus Points
Hasan	8.5	4						
Osama	8	4						
Tareq	7.5	3						
Mohd	8	4						
Saleh	6	2						
Total	**38**	**17**						
Group Award	**Great group**							

Figure 3.4 Example of a group summary sheet

The awards came in the form of a certificate. A large, fancy certificate (8.5 by 11 inches) was used for Super groups; Great groups received a similar but smaller

certificate. Good groups received congratulations in class. Additionally, a bulletin board displayed the week's Super groups and Great groups.

3.4 Conclusion

The method described in this chapter provides educators with a framework and set of recommendations for helping groups acquire effective collaborative learning skills. The method also provided a framework for the design of the collaborative learning procedures that were used in the experimental studies that are reported in Chapter 4, 5, and 6. In each of these studies, the general collaborative learning method was implemented according to the directions that were described above. However, in cases where the purpose of the study required modification, the method was tailored to these requirements. These adaptations are described in detail in the method sections of the Chapters 4, 5 and 6.

Chapter four

Effects of Collaborative Learning on Social Interaction, Academic Achievement, and Motivation to Learn

Abstract

This study compared the effects of two strategies of science learning—collaborative learning and individual learning— in elementary schools in the State of Kuwait. The effects of these strategies on students' academic achievement, social interaction, and motivation to learn were investigated. Fifty elementary fourth-grade students from two classes were assigned to experimental and control groups. Students in both conditions received four training sessions in collaborative learning and 16 plant biology lessons. Students in the experimental condition processed these lessons collaboratively; control students learned the same materials individually. Academic achievement was assessed using a pre- and posttest, four quizzes, and a group assignment. Group performance on the group assignment was videotaped and the transcripts were used to analyze social interaction. Motivational perceptions towards small-group learning were assessed using an initial and final motivation questionnaire. The results demonstrate that collaborative learning has a positive effect on student motivation to learn, social interaction, and academic achievement.

4.1 Introduction

Improving methods of instruction to promote higher levels of academic achievement is one of the important goals of educators today. One of the most common techniques employed to achieve this goal is preparing students to participate in collaborative learning groups. Collaborative learning is a process by which students work together in groups to master material initially presented by the teacher (Slavin, 1990). Collaborative learning encourages students to discuss, debate, disagree, and ultimately to teach one another. Compared to when a student learn the information

to take a test, achievement improves when students learn information to teach others (Webb, 1991).

Empirical evidence shows that students who work in collaborative learning groups achieve better results than those who study alone (Johnson & Johnson, 1990; McManus & Gettinger, 1996; Sharan, 1990; Slavin, 1990; Webb, 1982). Collaborative learning encourages students to participate more actively, which enhances their achievement (e.g., Webb, 1982). Others found that collaborative learning has a positive effect in increasing students' motivation toward learning (Johnson & Johnson, 1999; Sharan, 1990; Slavin, 1990; Webb, 1982). In addition, Johnson and Johnson (1993) state that the most powerful and effective source of feedback is other people. Receiving personalized feedback from another person increases performance to a greater extent than does receiving impersonal feedback (Fuller et al., 1969).

While these studies strongly demonstrate the benefits of working in collaborative learning groups, some studies have failed to confirm a positive relation between collaborative learning and learning outcomes and attitudes (Khaled, 1999; Klein et al., 1994; Peterson et al., 1981). The studies reported by Khaled are of particular relevance here because they were conducted in Kuwait schools. In Chapter 1, it was argued that these studies yielded no benefits of collaborative learning over individual learning because (1) both teachers and students were unfamiliar with collaborative learning, (2) teachers did not acknowledge the importance of social interaction in small-group learning, and (3) the duration of the introductory training and the actual study was too short.

The present study sought to address these limitations through an extensive introductory training in collaborative learning and by studying the effects of this learning strategy during a four-week course. The introductory training served to familiarize the teacher and his students with collaborative learning. It was designed according to the conditions for effective collaborative learning that were outlined in Chapter 2. In short, these conditions imply that students should feel individually responsible for the group's performance, possess social skills and be able to engage in promotive social interaction. An outline of the introductory training was presented in Chapter 3.

To assess whether these arrangements would produce the desired effects, this study compared students from a collaborative learning condition with students who learned the same content individually. Collaborative learning students were expected to surpass students from the individual learning condition on tests measuring academic achievement. Collaborative learning students were also assumed to be more motivated to work in small groups. Finally, collaborative learning students were hypothesized to show higher instances of promotive social interaction. That is, they were expected to participate more in the group interaction, and show higher degrees of productive interaction skills such as providing explanations, asking and answering questions, and engaging in argumentative discussions (e.g., Davey & McBride, 1986; King, 1994, 1997; Van Boxtel, 2000; Webb, 1991, 1995; Wittrock, 1990).

4.2 Method

4.2.1 Participants

Fifty fourth-grade students of an elementary school in the State of Kuwait participated in the experiment. All students were boys between ages of 9 and 10 years. Their school was selected based on the science teacher's agreement to teach two classes using two different strategies. This teacher had 10 years of experience in science education and was trained to teach the course content using the collaborative learning method described in Chapter 3.

The students came from two science classes. Prior to assigning students to learning groups, their final science grades of the previous year were compared between the two classes to determine students' ability. In order to achieve a balance between the two classes concerning student ability, some students were exchanged. Both classes were then divided into 5 mixed-ability groups of 5 students. Each group consisted of one high (grade A), one low (grade D) and three average-ability students (grades B or C). The learning groups in one class were then assigned to the collaborative learning condition; the groups from the other class were assigned to the individual learning condition.

4.2.2 Instruction

The instruction consisted of 16 plant biology lessons. Instructional content was adapted from a fourth-grade textbook and covered basic botanical topics (e.g., the parts of fruit, vegetables and flowers, their life cycle, and the way they store food) as well as advanced issues that are ill-structured and complex to fourth-graders (e.g., growing, preserving and using fruit and vegetables).

In the experimental condition, all lessons utilized a collaborative learning strategy that was adapted from Slavin's (1994) Student Teams and Achievement Divisions technique. Students received brief whole class instruction at the beginning of each class (approximately 10 minute) after which they moved to their respective groups and worked on tasks receiving tutoring from their fellow group members. Students received individual scores on various knowledge tests (which are explained below) and could earn bonus points for their group based on their test scores. The team with the best score for the previous week (determined by group performance on the task in addition to the bonus points) was acknowledged at the beginning of each week with verbal recognition from the teacher and a team certificate located in the classroom. An elaborate description of the instructional content and strategies is given in Chapter 3.

Participants in the control condition learned the same content through individual instruction. They received more detailed instruction from their teacher, and worked independently on tasks during the lessons. Control students completed the same knowledge tests as the collaborative counterparts.

4.2.3 Instruments

Motivational beliefs

The "How I feel about working in groups at school" questionnaire (McManus & Gettinger, 1996; see Appendix A) was administered to assess students' motivational beliefs towards collaborative learning. The 14 items of this questionnaire were grouped into three scales: (1) academic benefits, reflecting students' perceptions of their academic performance as a result of working in collaborative learning groups, such as getting better grades; (2) social benefits, reflecting students' perceptions of

social relationships in collaborative learning groups, such as getting to know others better; and (3) attitude benefits, reflecting students' attitude toward working in collaborative learning groups, such as having fun. Items were scored on a seven-point scale ranging from 1 (never true for me) to 7 (always true for me). Characteristics and the reliability of the questionnaire in this study are shown in Table 4.1.

Table 4.1

Characteristics of the scales of the motivation questionnaire

Scale	Number of items	Reliability value (Cronbach alpha)
Academic	5	.96
Social	6	.94
Attitude	3	.93

Note. N = 50.

Academic achievement

A pretest and a posttest measured the students' knowledge of plant biology. The pretest indicated the students' knowledge of this topic before the instruction; scores on the posttest denoted the students' understanding after the instruction. The pre- and posttest were identical and consisted of ten items that were based on the academic objectives from Table 3.1 (see also Appendix B). A distinction was made between open and closed questions. The five closed questions were directly related to the outcomes of the instruction and had only one correct answer. The open questions addressed information that was provided throughout the instruction, but was not directly taught or aligned with the outcomes of the instruction. In addition, there was more than one correct answer for each of the open questions. The maximum score on the pre or post-test was 100 points (10 for each item). Four quizzes assessed the weekly progress of students' academic achievement. Each quiz consisted of one open question. Appendix C contains the four quizzes. The maximum score on each quiz was 10 points.

A group assignment was administrated after instruction to assess collaborative learning outcomes (see Appendix D). It consisted of three open-ended questions to stimulate all group members to contribute to the answer. The maximum score was 20 points.

4.2.4 Procedure

All groups attended a preparatory training in collaborative learning. This introduction served to familiarize students (and their teacher) with small-group learning in general and the collaborative learning method in particular. Training comprised four 35-minute animal biology lessons and was adapted from procedures recommended by Webb and Farivar (1994). The training involved three phases: generation, practice, and reflection. Initially, students generated activities that benefited or limited group effectiveness. Next, students completed several collaborative activities. Following each activity they discussed ways to improve the effectiveness of group interaction. In order to reinforce interactions the students needed to work collaboratively, the purpose of the activities were explained to the collaborative learning students. After the final training session, students completed the initial motivation questionnaire and the pretest.

The next six weeks were devoted to the plant biology lessons. All groups attended four 35-minute lessons a week; individual quizzes were administered every fourth lesson. Students from both conditions attended these lessons in separate rooms.

Three assessment sessions were held following the entire instructional course. In session 1, intact learning groups were given 45 minutes to complete the group assignment. The groups' performance was recorded by five video cameras and a table microphone. In session 2, students once again filled out the motivation questionnaire. The individual posttest was administered during the final session.

4.2.5 Coding

Academic achievement

All achievement tests were judged by two elementary science teachers to ensure representative coverage of the course content and to check student familiarity with the types of test items. The teachers also assisted in constructing an answer key for each test. Students' answers were checked against this measure and points were allocated to each response. Inter-rater agreement estimates (Cohen's Kappa) between the two judges reached .85 for the pretest, .83 for the posttest, .89 for the quizzes and .89 for the group assignment.

Social interaction

Social interaction during the group assignment was scored from the transcribed videotapes using a validated coding schema (Van Boxtel, 2000). Transcripts were first segmented into utterances: a collection of words with a single communicative function. The number of utterances per student was used as a measure of participation in the group interaction. Each utterance was then categorized according to its communicative function. Table 4.2 presents an overview of main categories; a full account of the types of utterances is presented in Appendix E.

Two raters scored the transcripts of one group to assess inter-rater reliability. Agreement scores (Cohen's Kappa) reached .89 for participation/segmentation and .82 for the type of utterance.

4.2.6 Data Analysis

The study examined the effect of learning strategy (collaborative, individual) on academic achievement, social interaction, and motivational beliefs. A multivariate analysis of variance (MANOVA) was used to assess between-group differences on the pretest, posttest, and the four quizzes. Performance on the group assignment was analysed by a Mann-Whitney U test. A MANOVA was used to compare the scores on the two motivation questionnaires within each class and to assess the differences in motivation between conditions. A MANOVA was also used to analyse student's

participation in the group interaction (as indicated by the number of utterances) and the nature of their contributions (as expressed by the type of utterance).

Table 4.2

Types of utterances

Utterance type	Description	Example
Statement	Providing information	"Tomato is fruit"
Argument	Logic extension reflecting reasoning	"Meat can be stored in the freezer if there is electricity"
Evaluation	Personal opinion or judgment related to the task	"This is really difficult" "I really don't know"
Question	Asking for information and checking	"Is that a leave or a stem?" "Plants need sunlight to make food, don't they?"
Request for evaluation	Asking for the opinion or judgment of others	"Do you think this will be better?"
Request	Asking the other to pass an object or to repeat the utterance	"Can you give me that pencil?" "What did you say?"
Proposal	Suggestion for a common action or a task division	"Lets draw a plant" "When you draw, I will write"
Confirmation	Explicit support	"Yes"
Acceptance	Neutral support	"Mmm" "Okay"
Negation	Objection without explanation or an indignant repetition of what the other said	"No"
Repeat	Repeating of the previous utterance	"(The plant needs water) The plant needs water"
Order	Performing a verbal instructing act to the other	"Stop drawing!"
Off-task	Not related to the task	"How was your English test yesterday?"

4.3 Results

4.3.1 Academic achievement

Pretest scores were used to determine possible differences in prior knowledge between students in both conditions (see Table 4.3). A MANOVA produced no significant difference ($F(2,47)=0.25$, $p=.78$), indicating that students in both conditions were equally knowledgeable about the subject being taught. Moreover, as

the students' pretest scores were rather low, it is probably safe to assume that they had little prior knowledge of the subject being taught in the experiment.

Table 4.3

Means and standard deviations for the pre- and posttest

Question type	Collaborative learning		Individual learning	
	M	**SD**	**M**	**SD**
Pre-test				
Open[1]	10.0	4.5	10.1	4.8
Closed[2]	13.7	5.6	13.4	5.3
Total	23.7	10.1	23.5	10.1
Post-test				
Open[1]	45.0	4.5	30.8	8.0
Closed[2]	45.7	3.1	43.5	8.7
Total	90.7	7.6	74.3	16.7

Note. The test consisted of 10 items. Maximum score = 100
[1] Open questions have more than one answer. Maximum score = 50
[2] Closed question allow for a single correct answer. Maximum score = 50

Table 4.3 also shows the posttest scores. As can be seen from the total scores, students in the collaborative learning condition outperformed their individual counterparts on this test. A MANOVA revealed that this difference was statistically significant ($F(2,47)=94.39$, $p<.01$). A significant univariate effect was found for open questions ($F(1,48)=60.15$, $p<.01$). No difference was found for the closed questions ($F(1.48)=1.47$, $p=.23$), indicating that the superior post-test scores of the collaborative group is attributable to their performance on the open questions.

As Table 4.4 shows, students from the collaborative learning condition also performed better on the four quizzes that were administrated after each week ($F(4,45)=15.64$, $p<.01$). In addition, the mean scores for the first quiz showed a relatively small difference between the two conditions ($F(1,48)=9.39$, $p<.05$) with an effect size estimate of .76. The results for subsequent quizzes also differed in favor of students from collaborative learning groups ($F(1,48) > 18.38$, $p <.01$), and the magnitude of these effects was higher (see Table 4.4).

Table 4.4

Mean scores and standard deviations for the quizzes

| Quizzes | Learning strategy | | | | Effect size |
| | Collaborative learning | | Individual learning | | |
	M	SD	M	SD	
Quiz 1	7.8	1.4	6.5	1.7	.76
Quiz 2	8.4	1.1	6.5	1.9	1.00
Quiz 3	9.0	.9	6.6	1.7	1.41
Quiz 4	9.3	.7	6.5	2.0	1.40

Note. Each quiz consisted of one open question. Maximum score for each quiz = 10.

The scores on the group assignment revealed that students in the collaborative learning condition performed better (M=19.5; SD=.5) than students from the individual learning condition did (M=15.0; SD =.9). A Mann-Whitney U test indicated that this difference was statistically significant (Z=2.64, $p<.01$).

4.3.2 Social interaction

Social interaction was assessed from the transcribed video recordings, which were collected while students from both conditions were working on the group assignment. In all, the transcripts contained 560 utterances (369 utterances for the experimental group and 191 for the control group). The data from Table 4.5 indicate that on average students in the collaborative learning condition produced more utterances, and therefore participated more actively in the group interaction that students from the individual learning condition ($F(1,48)$=75.6, $p<.01$).

Table 4.5

Descriptive statistics for number of utterances per student

Learning strategy	M	SD	Minimum	Maximum
Collaborative learning	14.8	2.6	10	20
Individual learning	7.6	3.7	1	13

Note. N = 50

Table 4.6 shows the mean percentages and standard deviations for the types of utterances. Learning strategy had a multivariate effect on this measure ($F(13,36)=9.08$, $p<.01$). Subsequent univariate analyses revealed that students in the individual learning condition exhibited significantly more off-task utterances than students in the collaborative learning condition ($F(1,48)=7.4$, $p<.01$). In contrast, collaborative learning students showed higher proportions of statements ($F(1,48)=56.2$, $p<.01$), arguments ($F(1,48)=46.8$, $p<.01$), evaluations ($F(1,48)=7.1$, $p<.05$), questions ($F(1,48)=7.7$, $p<.01$), proposals ($F(1,48)=13.2$, $p<.01$), and confirmations ($F(1,48)=10.7$, $p<.01$). No significant differences were found for the remaining types of utterances ($F(1,48) < 3.19$, $p>.09$).

Table 4.6

Mean percentages and standard deviations for types of utterances

| | Learning strategy | | | |
| | Collaborative learning | | Individual learning | |
Utterance type	M	SD	M	SD
Statement	27.4	1.64	23.0	.84
Argument	25.7	.71	21.5	1.10
Evaluation	3.8	.45	2.1	.45
Question	10.3	.89	12.0	.89
Request for evaluation	2.2	.45	1.6	.45
Request	1.1	.45	2.6	.00
Proposal	7.9	.84	5.8	.84
Confirmation	8.7	.55	7.3	.45
Acceptance	5.1	.89	5.8	.45
Negation	1.4	.74	3.1	.45
Repeat	3.5	.55	3.1	.45
Order	1.6	.45	3.7	.55
Off-task	1.4	.00	8.4	1.10

Note. N = 50.

4.3.3 Motivational beliefs

The means and standard deviations for students' motivational beliefs are displayed in Table 4.7. A MANOVA produced no significant difference for initial motivation ($F(3,46)$=2.0, p=.13), indicating that students in both conditions were equally motivated to learn in groups. The height of the scores further suggests that students expected collaborative learning to be challenging.

After the sixteen plant biology lessons and the group assignment, the scores on the final motivation questionnaire showed an increase in students' stance towards working in groups. As can be seen from Table 4.7, the overall scores differed in favor of students from the collaborative learning condition ($F(3,46)$=10.7, p <.01). Significant univariate effects were found for academic benefits (F(1,48)=21.22, p<.01), social benefits ($F(1,48)$=20.42, p<.01), and attitudes ($F(1,48)$=18.07, p<.01).

Table 4.7

Means and standard deviations for motivational beliefs

| | Learning strategy | | | |
| | Collaborative learning | | Individual learning | |
	M	SD	M	SD
Initial motivation				
Academic	5.5	1.2	5.5	1.1
Social	5.1	.6	5.6	.7
Attitude	6.0	.9	6.9	.8
Total	16.6	2.7	18.0	2.6
Final motivation				
Academic	6.7	.4	6.0	.6
Social	6.6	.3	6.0	.6
Attitude	6.8	.4	6.1	.7
Total	20.1	1.1	18.1	1.9

Note. The two questionnaires were identical and consisted of 14 items. Maximum score = 7

A repeated measures MANOVA produced significant differences between initial and final motivation scores within the collaborative learning group ($F(3,22)$=71.11, p<.01). Univariate effects were found for academic benefits ($F(1,24)$=21.08, p<.01),

social benefits ($F(1,24)=200.73$, $p<.01$), and attitude ($F(1,24)=29.47$, $p <.01$). There was also a significant main effect within the individual learning condition ($F(3,22)=3.54$, $p<.05$). Univariate analyses bore out that this effect was attributable to the increase in social benefit scores ($F(1,24)=6.10$, $p<.05$). No significant differences were found for gains in academic benefits ($F(1,24)=2.91$, $p=.10$) and attitude ($F(1,24)=.38$, $p=.58$).

4.4 Discussion

The main purpose of this study was to investigate the effects of implementing collaborative learning strategies versus individual learning strategies on fourth-grade science students in the State of Kuwait. The study compared the effect of both strategies on academic achievement, social interaction, and motivational belief towards learning in groups. The results generally support the positive effects of collaborative learning found in previous studies.

Scores on the academic achievement tests confirm the hypothesis that collaborative learning is more effective than learning alone. Students who learned in groups performed significantly better on the group assignment and achieved significantly higher scores on the individual posttest and the quizzes. However, achievement differences on the posttest were found only for open questions. On closed questions that allow for a single correct answer, no significant difference was found. This result is consistent with the notion that collaborative learning tasks should be open-ended (cf. Cohen, 1994) and emphasizes the importance of social interaction in small-group learning.

The scores on the quizzes revealed a steady improvement in achievement from quiz 1 to 4 in the collaborative learning condition, whereas no achievement gains were observed in the individual learning condition. This suggests that students in the collaborative learning condition became more proficient in collaborative learning during the plant biology course. Students confirmed this by saying that "this is the first time we are studying in such a way and since we had more time to experience this strategy, we achieved more". Other researchers have also noted that students require time to adjust to collaborative learning (Slavin, 1983) and that training in

collaborative skills before the start of collaborative learning activities will help ensure those students will work together effectively (Johnson & Johnson, 1999). Students in the present study faced some difficulties during the first week of the plant biology course, but from the second week on they showed more proficiency in working together as a team. This suggests that future studies should include at least two weeks of training before starting utilizing collaborative learning.

The results also support the hypotheses pertaining to social interaction. Students in the collaborative learning condition participated more actively in the group discussion in that they produced significantly more utterances than the control group students. Collaborative learning students also showed higher degrees of productive interaction skills (i.e., statements, arguments, evaluations, questions, proposals, and confirmations). These utterances are prevalent in productive learning dialogues such as providing explanations, asking and answering questions, and engaging in argumentative discussions. The present study thus seems to confirm the relationship between social interaction and academic achievement.

However, the present study merely provides indirect support for the effects of social interaction on learning. As interaction data were collected during the group assignment, it remains unclear how students interacted during the lessons and how these discussions affected learning. Further research should therefore record and examine social interaction during the lessons, and compare these data with measures indicating learning outcomes. A second recommendation would be to investigate rather than assume the relationship between types of utterances and productive interactions such as providing explanations, asking and answering questions, and engaging in argumentative discussions.

The results of present study also revealed that collaborative learning has beneficial effects on the students' motivational beliefs. The initial motivation questionnaire scores indicated that students from both conditions expected collaborative learning to be challenging. The scores on the final motivation questionnaire showed an improvement in the motivational beliefs towards collaborative learning for students from the collaborative learning condition. These gains offer support for previous findings that collaborative learning promotes a positive change in student beliefs and motivation to learn (Johnson & Johnson,

1990; Slavin, 1990). The data also support the conclusion by Gillies and Ashman (1996) that training students in collaborative learning results in a more positive perception of the groups as a social and safe environment. While it seems plausible that a more positive perception of the learning climate encouraged students to participate more in the group interaction, this assumption could not be validated due to the fact that interaction data were collected during the group assignment only.

To conclude, this study demonstrated that collaborative learning can be successfully implemented in Kuwait elementary schools. Factors that seem to contribute this success include a thorough preparatory training for both students and teachers, emphasis on promotive social interaction during the training and the experimental sessions, and a sustained period of utilizing collaborative learning. In view of these positive findings, it might be interesting to examine whether these effects generalize to different audiences, in particular students from secondary education because they participated in the unsuccessful attempts to introduce collaborative learning in Kuwait schools (Khaled, 1999).

Additionally, the present study confirmed the effectiveness of the collaborative learning method that was outlined in Chapter 3. Experiences gained during data collection and data analysis further yielded valuable insights into how this method and the experimental procedures could be further improved. Once these changes are made, the current methodology seems fit for studying the effects of within-class ability grouping.

Chapter Five

Effects of Within-Class Ability Grouping on Social Interaction, Achievement, and Motivation[1]

Abstract

This study examined how grouping arrangements affect students' achievement, social interaction, and motivation. Students of high, average and low ability were randomly assigned to homogeneous or heterogeneous ability groups. All groups attended the same plant biology course. The main results indicate that low-ability students achieve more and are more motivated to learn in heterogeneous groups. Average-ability students perform better in homogeneous groups whereas high-ability students show equally strong learning outcomes in homogeneous and heterogeneous groups. Results on social interaction indicate that heterogeneous groups produce higher proportions of individual elaborations, whereas homogeneous groups use relatively more collaborative elaborations. In the discussion, these differences in social interaction are used to explain the differential effects of grouping arrangements on achievement scores. Practical implications are discussed and topics for further research are advanced.

5.1 Introduction

The concept of collaborative learning has been studied for over 30 years. Despite this long-standing history there is still some controversy over the exact definition of ''collaborative learning''. By and large, the term refers to a pedagogy in which students of equal status work together in small groups toward a common goal.

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[1] Saleh, M., Lazonder, A.W., & De Jong, T. (2005). Effects of within-class ability grouping on social interaction, achievement, and motivation. *Instructional Science, 33*, 105-119.

This form of teaching and learning has repeatedly been found to lead to educational advantages over individual learning methods. One of the most salient benefits which can be interpreted from the literature on collaborative learning is the increase in academic achievement (Johnson et al., 1993; Slavin, 1995). Other studies have demonstrated facilitative effects from collaborative learning on social and communication skills as well as on student motivation (Johnson & Johnson, 1999).

While the superiority of collaborative learning is well-established, there appears to be no single best way to divide students into learning groups. The most widely studied issue underlying group composition is whether groups should be composed of students who are similar or dissimilar in ability. Lou et al. (1996) reviewed twelve studies comparing the effects of homogeneous ability grouping to heterogeneous ability grouping. Their meta-analysis revealed that the effects of group ability composition are different for students of different relative ability. Low-ability students learn more in heterogeneous groups, average-ability students achieve more in homogeneous groups, and high-ability students learn just as much in either group.

Social interaction might be the key to understanding these differential effects, especially because it is generally considered an important mediational factor in small-group learning. From an epistemological viewpoint, two lines of interpretation have emerged. The first dwells on the notion that group learning stimulates peer elaboration. Giving explanations encourages a student to clarify and reorganize the material to make it understandable to others. Such elaborative talk helps both parties to understand the material better. The gains for the students receiving explanations are self-evident. The explainer benefits from the cognitive restructuring involved in peer tutoring in that it might trigger the detection and repair of misconceptions and knowledge gaps (e.g., Webb & Palinscar, 1996). The second interpretation emphasizes the role of peer interaction in the social construction of knowledge. According to this view, knowledge is being co-constructed by group members on the basis of equal partnership. Students construct a shared understanding of a given topic by building on each other's ideas, discussing the significance of personal beliefs until mutual agreement is reached (Damon & Phelps, 1989; Slavin, 1995).

The knowledge basis that results from these argumentative discussions is synergetic by nature and shared by all group members.

It is not the mere production of talk that mediates the construction of knowledge. Learning dialogues should include specific types of verbalizations for peer elaboration and co-construction to occur. Although both processes are elicited by the same kinds of verbal behavior, namely asking and answering of questions, reasoning and conflict resolution, they differ in focus. Peer elaboration pertains to the individual knowledge construction that results from group interaction, whereas co-construction focuses on the way in which a group of students interacts to come to a shared understanding of the subject matter. Van Boxtel (2000) united both perspectives by considering elaboration as a social process that can be either individual or collaborative. Individual elaboration occurs when only one student answers a question, solves a conflict or reasons about the subject matter. In collaborative elaboration, more than one student participates in questioning, reasoning or conflict resolution. Individual and collaborative elaborations can coexist in an intra-group learning discourse and their occurance rate correlates positively with achievement outcomes.

Van Boxtel's framework might be helpful to understand the effects of within-class ability grouping. Our main assumption is that the instructional efficacy of giving and receiving individual and collaborative elaborations differs as a function of group composition and student ability. That is, the extent to which students of high, average and low ability benefit from individual and collaborative elaborations depends on whether they are assigned to homogeneous or heterogeneous ability groups. Evidence supporting this notion is particularly apparent for low-ability students. While giving individual and collaborative elaborations is generally more productive to learning than receiving it (Webb, 1992), this conclusion does not apply to low-ability students. These students benefit most from the social interaction involved in collaborative learning because they can ask their group mates for help and explanations. As they are more likely to receive the support they need from more capable peers, low-ability students learn more by being in groups with higher-ability students than in groups with only low-ability students (Azmitia, 1988; Hooper & Hannafin, 1991).

Research on high-ability students has produced inconsistent findings. Some studies found that high-ability students generate more cognitive conflicts and produce more collaborative elaborations when grouped homogeneously. Their performance was therefore superior to that of high-ability students in mixed ability groups (Fuchs, Fuchs, Hamlett, & Karns, 1998; Hooper & Hannafin, 1988, 1991). Webb (1991) reached a different conclusion. She found that high-ability students perform better in heterogeneous groups than in homogeneous groups because they assume the role of the teacher and give more explanations in heterogeneous groups than in homogeneous groups. Azmitia (1988), however, found no differences in social interaction between high-ability students from homogeneous and heterogeneous groups. The extent to which high-ability students gave explanations and engaged in conflicts was independent of the group's ability structure. As the task performance scores did not differ either, it was concluded that high-ability students typically perform well regardless of whether they work with equally capable peers or with lower ability students (cf. Hooper, Ward, Hannafin, & Clark, 1989).

Research on average-ability students is scant. Webb (1982, 1991) demonstrated that average-ability students in homogeneous groups receive more explanations than those in mixed-ability groups. The latter students may be at a disadvantage because they may be excluded from teacher-learner relationships that develop between high and low achievers and are given few opportunities to participate in the group's interaction. In homogeneous groups, average-ability students played a more active role in the learning discourse and learned more compared with average-ability students in heterogeneous groups.

Group composition and student ability thus have a joint and differential effect on student achievement during collaborative learning. Research suggests that these effects are attributable to social interaction, but evidence regarding the nature of this relationship is both incomplete and inconclusive. This may, in part, be due to the fact that the cited studies used various instructional treatments, participants from different age groups, and different operationalizations of ability level. Another part stems from the seeming lack of attention to average-ability students. Both factors make it difficult to generalize across studies or merge pieces of evidence into a comprehensive and coherent explanation. The present study therefore aimed to

examine how social interaction mediates learning for students of high, average, and low ability in heterogeneous and homogeneous ability groups. More specifically, the study sought to uncover (1) how group composition and student ability affect learning outcomes; (2) whether the type of interaction depends on group composition; and (3) how differences in achievement scores can be explained from social interaction.

The study also expands existing research by addressing the students' motivational beliefs. Although students generally favor collaborative learning over individual teaching methods (Slavin, 1990), it is unknown whether group composition affects their views on collaborative learning *per se*. Yet students of different ability could hold different perceptions on the benefits of working in homogeneous or heterogeneous groups. High-ability student who believe that working with lower ability students may hinder their progress, might be more motivated to work in homogeneous ability groups. Conversely, less able students could be more motivated to learn in heterogeneous groups as the presence of more capable peers offers them a greater chance to improve their performance.

Although academic benefits contribute to a student's stance toward collaborative learning, it is not the only factor. When students create groups, they are more likely than teachers to form homogeneous groups with respect to gender and ethnicity (Webb, Baxter, & Thompson, 1997). These findings further suggest that social aspects of collaboration can influence student motivation. Some students may find it particularly rewarding to help others or to get to know fellow students better; other students may be more motivated to learn in familiar settings among friends.

5.2 Method

5.2.1 Participants

Participants were 104 fourth-graders from five classes in an elementary school in Kuwait. All students were boys between the ages of 9 and 10 years. Students were classified as being of relatively high, average, or low ability according to their performance on the Science Elementary Achievement Test (SEAT) – a standard

basic science skills test in Kuwait. Scores on this test correlated 0.89 with pretest scores reported in Table 5.1. Students with ability scores in either the upper or lower 25% of the distribution were assigned to the high and low ability levels, respectively. Students in the middle 50% of the distribution composed the average ability level.

One high, one low, and two average ability students were randomly assigned to one of the 13 heterogeneous groups. The homogeneous condition also consisted of 13 groups: 4 high, 5 average, and 4 low ability groups with 4 members per group. This gave 52 students in each condition. To achieve a balance between experimental conditions, 4 students exchanged between 2 classes; the other students participated as members of their intact classrooms.

5.2.2 Instruction

The instruction consisted of 16 plant biology lessons. Instructional content was adapted from a fourth-grade textbook and covered basic botanical topics (e.g., the parts of fruit, vegetables and flowers, their life cycle, and the way they store food) as well as advanced issues that are ill-structured and complex to fourth-graders (e.g., growing, preserving and using fruit and vegetables). All lessons applied a collaborative learning strategy that was adapted from Slavin's (1994) Student Teams and Achievement Divisions technique. Students received a brief whole-class introduction at the beginning of each lesson. Students then went to their respective groups and worked collaboratively on learning tasks receiving tutoring from their fellow group members. Students received individual scores on various individual tests (quizzes, pre- and posttest), and could earn bonus points for their groups based on their quiz scores. The team with the best score for the previous week (determined by group performance on the task in addition to the bonus points) was acknowledged at the beginning of the week.

5.2.3 Instruments

Motivational beliefs

The ''How I feel about working in groups at school'' questionnaire (McManus & Gettinger, 1996) was administered to assess students' motivational beliefs towards collaborative learning. The 14 items of this questionnaire were grouped into three scales: (1) academic benefits, reflecting students' perceptions of their academic performance as a result of working in collaborative learning groups, such as getting better grades; (2) social benefits, reflecting students' perceptions of social relationships in collaborative learning groups, such as getting to know others better; and (3) attitude benefits, reflecting students' attitude toward working in collaborative learning groups, such as having fun. Items were scored on a seven-point scale ranging from 1 (never true for me) to 7 (always true for me). All scales demonstrated satisfactory psychometric properties with internal consistency reliabilities in excess of 0.93.

Academic achievement

A pre- and post-test assessed the students' individual knowledge gains. Both tests were identical and consisted of ten items. The maximum score for both tests was 100 points (10 points for each item). A group assignment measured collaborative learning outcomes. It consisted of three open-ended questions to stimulate all group members to contribute to the answer. The maximum score was 20 points.

5.2.4 Procedure

The study was performed over a nine-week period. During the first week, the SEAT and the pretest were administered to classify students according to their relative ability level. Students of high, average, and low ability were assigned to homogeneous or heterogeneous groups. All groups attended a preparatory training in collaborative learning. This introduction served to familiarize students (and their teacher) with small-group learning in general and Slavin's (1994) collaborative learning strategy in particular. Training comprised eight 35-min animal biology lessons and was given by the first author. After the final training session, students

completed the initial motivation questionnaire. The next four weeks were devoted to the plant biology lessons. All groups attended four 35-min lessons a week; individual quizzes were administered every third lesson. Three assessment sessions were held following the entire instructional course. In session 1, intact learning groups were given 45 min to complete the group assignment. In session 2, students once again filled out the motivation questionnaire. The individual posttest was administered during the final session.

5.2.5 Coding

Academic achievement

All achievement tests were judged by two elementary science teachers to ensure representative coverage of the course content and to check student familiarity with the types of test items. The teachers also assisted in constructing an answer key for each test. Students' answers were checked against this measure and points were allocated to each response. Inter-rater agreement estimates (Cohen's Kappa) between two judges reached 0.89 for the pretest, 0.86 for the post-test, and 0.89 for the group assignment.

Social interaction

During the instruction each team was videotaped 3 times for approximately 10 min. Recordings were made randomly during the second, fifth, and eighth week. Social interaction was scored from the transcribed videotapes using a validated coding schema (Van Boxtel, 2000). First, transcripts were segmented into utterances: a collection of words with a single communicative function. Each utterance was then categorized according to its communicative function. A distinction was made between statements, arguments, evaluations, questions, requests, proposals, confirmations, negations, repetitions, orders, and off-talk utterances.

Utterances were then grouped into episodes: a set of expressions that are meaningful at the content level. A distinction was made between question, conflict, and reasoning episodes because these episodes underly both types of elaborative talk. Question episodes contained a question (disjunctive, verification, and open)

and a series of utterances that can be considered an elaborated response to that question. Short answers (e.g., ''yes'', ''no'', ''the answer is 36'') were not taken into account. Conflict episodes comprised either negations, counter-arguments or critical questions; Reasoning episodes were defined as a sequence of utterances in which definitions, observations or hypotheses about the instructional content were related to each other. A reasoning episode contained at least one utterance that was coded as an argument.

Episodes were further classified as individual or collaborative elaboration. In cases where a single student answered a question, resolved a conflict or engaged in reasoning, the episode was classified as individual elaboration. When more than one student added to the conversation the episode was considered an act of collaborative elaboration.

Two raters scored the transcripts of five groups to assess inter-rater reliability. Agreement scores (Cohen's Kappa) reached 0.88 for the utterance level and 0.82 for the episodic level.

5.2.6 Design and data analyses

The study employed a between-subjects design with group composition (homogeneous, heterogeneous) and student ability (high, average, low) as the independent variables. This 2 x 3 design was used to analyze individual test scores and motivational beliefs. For analyses comparing group assignment scores and social interaction, group composition and student ability were converted into a single factor with four levels (heterogeneous, homogeneous-high, homogeneous-average, and homogeneous-low). All data were analyzed using analysis of variance. Where appropriate, multivariate MANOVA's preceded univariate ANOVA analyses. *Post hoc* comparisons among means were performed through Tukey tests (alpha was set at 0.05). Correlational analyses were conducted to examine the relationships between social interaction and academic achievement.

5.3 Results

5.3.1 Academic achievement

Pretest scores were used to determine possible differences in prior knowledge (see Table 5.1). Overall, pretest scores for heterogeneous groups ($M = 24.6$, $SD = 8.8$) and homogeneous groups ($M = 24.2$, $SD = 8.7$) did not differ ($F(1,98) = 1.45$, $p = 0.23$), indicating that students in both groups were equally knowledgeable about the subject being taught. Student ability affected pretest scores ($F(2,98) = 246.61$, $p < 0.01$). As the interaction between group composition and student ability was not significant ($F(2,98) = 1.02$, $p = 0.36$), these differences were not controlled for in the analyses.

Analysis of post-test scores produced a main effect of group composition ($F(1,98) = 11.15$, $p < 0.01$), a main effect of student ability ($F(2,98) = 406.50$, $p < 0.01$) and a significant interaction ($F(2,98) = 35.14$, $p < 0.01$).

Table 5.1

Mean scores (and standard deviations) for the individual pre- and post-test

Group composition	Ability	Pretest	Posttest
Heterogeneous	High (*n*=13)	37.3 (4.2)	92.6 (5.7)
	Average (*n*=26)	23.0 (3.7)	82.4 (4.2)
	Low (*n*=13)	15.2 (2.5)	67.1 (5.7)
Homogeneous	High (*n*=16)	34.9 (4.6)	93.5 (5.3)
	Average (*n*=20)	22.9 (3.7)	86.2 (3.9)
	Low (*n*=16)	15.0 (2.5)	53.1 (3.1)

Note. Both tests had a maximum score of 100.

Figure 5.1 illustrates how the effect of group composition was moderated by student ability. Tukey's pairwise comparisons for cell means showed that the scores of high-ability students were comparable across conditions. Average-ability students from homogeneous groups outperformed their heterogeneously grouped counterparts.

This superiority was reversed for low-ability students: they achieved higher scores when learning in mixed-ability groups.
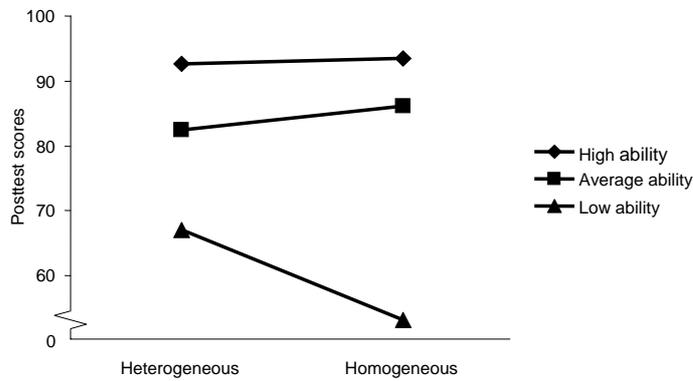
Figure 5.1 Individual posttest scores as a function of group composition and student ability

As can be seen from Table 5.2, group composition affected performance on the group assignment. Overall, the scores differed in favor of the heterogeneous groups ($F(3,22) = 140.28$, $p < 0.01$). *Post hoc* comparisons indicated that heterogeneous groups performed significantly better than homogeneous groups of average and low-ability students. No differences were found for high-ability groups.

Table 5.2

Mean scores (and standard deviations) for the group assignment

	Homogeneous			**Heterogeneous**
	High	Average	Low	
Scores	19.25 (0.96)	15.60 (1.34)	6.56 (0.58)	19.0 (1.16)

Note. $N = 26$.

5.3.2 Social interaction

The transcripts contained 747 episodes: 382 for the heterogeneous group and 365 for the homogeneous group. The mean percentages and standard deviations of episode

categories are shown in Table 5.3. Group composition had a multivariate effect on this measure ($F(18,57) = 7.51$, $p < 0.01$). As shown in Table 5.3, all univariate analyses reached statistical significance.

Post hoc tests contrasted the heterogeneous group with the three homogeneous groups. Compared with low-ability groups, occurance rates of all episodes pertaining to individual elaboration differed in favor of the heterogeneous groups. Heterogeneous groups also engaged more often in collaborative reasoning. The other comparisons did not reach significance.

Compared with average and high-ability groups, heterogeneous groups again produced higher proportions of individual elaboration episodes. All differences regarding this measure were significant at the 0.05 level. Conversely, the ratios of all collaborative episodes were significantly higher for both average and high-ability groups.

Table 5.3

Mean percentages (and standard deviations) of episodes

Type of episode	Homogeneous			Heterogeneous	*F*
	High	Average	Low		
Individual elaboration					
Question episodes	14.3 (3.6)	13.3 (1.5)	10.9 (2.9)	26.2 (4.3)	29.21*
Conflict episodes	9.5 (2.1)	8.7 (2.6)	8.8 (3.2)	19.1 (3.1)	26.27*
Reasoning episodes	10.6 (2.6)	10.2 (2.6)	13.4 (2.9)	25.1 (3.2)	47.85*
Collaborative elaboration					
Question episodes	24.6 (3.3)	27.1 (4.5)	9.9 (2.1)	10.3 (2.6)	53.27*
Conflict episodes	16.3 (1.9)	14.1 (1.3)	5.5 (2.4)	6.8 (2.4)	31.48*
Reasoning episodes	20.9 (2.4)	19.5 (2.5)	1.9 (2.2)	6.6 (2.2)	84.61*

Note. $N = 26$. * $p<.01$

Partial correlations, controlling for individual pretest scores, were computed between the occurance rates of episodes and post-test scores. In homogeneous

groups, higher learning gains were associated with overall higher proportions of collaborative episodes ($r = 0.91$, $p < 0.01$). Learning gains were independent of the proportion of individual episodes ($r = -0.07$). In heterogeneous groups, neither type of episode correlated with post-test scores ($r = 0.02$ for both types of episodes). While it might be interesting to examine these relations for students of different ability, this would result in cell sizes to small for meaningful statistical analysis.

5.3.3 Motivational beliefs

The students' motivational beliefs towards collaborative learning were assessed before and after the instruction. The final motivation scores are displayed in Table 5.4. A MANOVA, using the initial scores as covariates, produced no effect for group composition ($F(3,93) = 2.18$), a main effect for student ability ($F(6,188) = 2.75$, $p < 0.05$) and a significant interaction effect ($F(6,188) = 9.48$, $p < 0.01$). Figure 5.2 displays the overall group x ability interaction; similar patterns were obtained for academic, social and attitude scales.

Table 5.4

Mean scores (and standard deviations) for motivational beliefs toward collaborative learning

Group composition	Ability	Academic	Social	Attitude
Heterogeneous	High (*n*=13)	4.7 (0.5)	5.3 (0.8)	5.6 (0.9)
	Average (*n*=26)	5.6 (0.9)	5.3 (0.5)	5.9 (0.8)
	Low (*n*=13)	6.1 (0.8)	5.9 (0.6)	6.6 (0.4)
Homogeneous	High (*n*=16)	5.5 (0.7)	5.9 (0.6)	6.2 (0.6)
	Average (*n*=20)	6.4 (0.6)	5.9 (0.5)	6.7 (0.5)
	Low (*n*=16)	5.2 (0.7)	4.8 (0.4)	5.0 (0.3)

Tukey's pairwise comparisons indicated that heterogeneously grouped low-ability students thought more positively of collaborative learning than low-ability students from homogeneous groups. For average and high-ability students, motivation scores

differed in favor of the homogeneous groups, but this effect did not reach statistical significance.
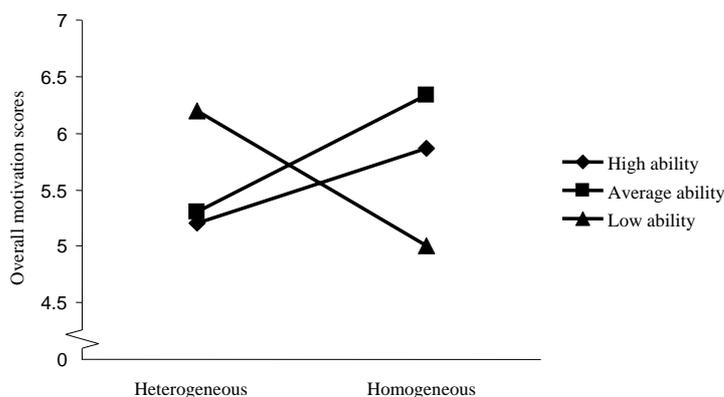
Figure 5.2 Motivational beliefs as a function of group composition and student ability

5.4 Discussion

The first goal of this study was to assess the effects of group composition on students' academic achievement. Results indicate that neither form of grouping is uniformly superior for promoting the achievement of all students. On the group assignment, heterogeneous groups outperformed homogeneously grouped low and average-ability students, but performed as well as homogeneous groups of high-ability students. Individual post-test scores demonstrate significant benefits of heterogeneous grouping for low-ability students. However, learning in homogeneous groups appears to be more effective for average-ability students, whereas high-ability students learn as much in either group. These results are consistent with the findings reported in Lou et al. (1996), and largely converge with other studies not included in this research integration (e.g., Azmitia, 1988; Hooper & Hannafin, 1991; Webb, 1991).

Group composition also affects the nature of the learning dialogue. Homogeneous grouping yields higher proportions of collaborative elaborations. Compared with heterogeneous groups, students of similar ability more often

complement and build on each other's thoughts when answering questions, resolving conflicts, or reasoning about the course content. As these episodes correlate positively with achievement gains, learning in homogeneous groups depends on discussing the course content on the basis of equal partnership. However, these conclusions do not apply to low-ability students who, in absence of more capable peers, give and receive very few elaborated explanations among themselves.

Heterogeneous grouping arrangements yield relatively more individual elaborations. *Post hoc* analyses revealed that the social interaction in heterogeneous groups resembles a teacher-learner dialogue. Low-ability students asked eight times as many questions as average-ability students. High-ability students asked no questions at all, but provided about 75% of the explanations (both individual and collaborative elaborations). Average-ability students contributed to a mere 15% of the explanations, which barely exceeds the amount of explanations given by low-ability students (10%). This in turn might explain why learning gains in heterogeneous groups were not associated with individual elaborations. As average-ability students give and receive very few explanations, their learning gains are probably independent of the amount and type of social interaction. This might account for the absence of significant correlations, especially because half of the students in heterogeneous groups were of average ability. Although it would be interesting to validate this assumption, and to assess the effects of individual elaborations for high and low-ability students, this study's sample size was too small to examine for these differential effects.

As with learning outcomes, group composition has a differential effect on students' motivational beliefs. Low-ability students are more motivated to learn in heterogeneous groups; the ratings of average and high-ability students do not differ as a function of group composition. From these findings one might infer that more capable students consider helping others just as valuable as discussing the course content with equally capable peers. This is not necessarily the case, however. As the pattern in motivation scores was consistent across subscales, students' perceptions of academic, social and attitude benefits may be related. *Post hoc* analyses bore this out. For the total sample, scores on the academic subscale correlated 0.48 with

social benefits and 0.63 with attitude benefits. One explanation is that fourth-grade children are unable to differentiate between the various benefits that result from collaborative learning. Another interpretation is that the benefits of collaborative learning are indeed interdependent. If for instance students strongly believe that their groupwork enhances academic gains, they may also have a more positive stance toward the social and attitude benefits that result from collaborative learning.

Taken together, these finding demonstrate the implications of teachers' grouping practices. Primary education teachers tend to form heterogeneous groups in relation to the composition of their classrooms (Webb et al., 1997). These grouping arrangements are especially beneficial to low-ability students: they get higher learning gains and are more motivated when learning with more capable peers. Using heterogeneous grouping for high-ability students does not affect achievement or motivation. However, heterogeneous grouping does hold back average-ability students. As intact classrooms consist mainly of average achievers (especially when students' ability is judged relative to their class mates), teachers prefer grouping practices that, ironically, tend to inhibit the majority of their students. Differentiated grouping arrangements might therefore be a more fruitful approach. Teachers could for instance create heterogeneous groups of high and low-ability students and place the remaining average-ability students in homogeneous groups.

This suggestion tacitly assumes that teachers use small-group learning merely as a means to improve students' academic achievement. Fortunately though, many teachers also consider collaborative learning as a goal in itself, a result of which is that students learn to work together in groups. These teachers might use heterogeneous groups for all students, and instruct them to perform learning activities that are known to enhance learning. Such scripted collaboration could encourage average-ability students to play a more active role in the learning process. For instance, a teacher might introduce students to question asking strategies (cf. King, 1997), and require turn taking in answering these questions. Although research shows that collaboration scripts can enhance learning (e.g., Weinberger, 2003), the effects of scripted collaboration in different ability groups has not yet been established. Future research should address this issue.

Future research should also examine how the current findings can be generalized to online collaboration. In computer-supported collaborative learning environments, student interaction is usually mediated by text-based tools such as email, discussion groups or chat boxes. While these tools enable students to participate in on-line discussions, they provide no guidance to students during these dialogue sessions. Hence, specific features might be added to communication tools to increase the likelihood of effective discussions. This study suggests that support for social interaction should depend on the group's ability structure. Homogeneous groups are likely to benefit more from support mechanisms that facilitate collaborative elaborations. Heterogeneous groups might benefit more from tools that support individual elaborations. Research should examine if and how such support can be tailored to the groups' prevalent type of social interaction. Such attempts would thus use and expand the results from traditional classroom studies to more contemporary forms of learning and instruction.

Chapter six

Effects of Scripted Collaboration on Social Interaction, Academic Achievement, and Motivation[2]

Abstract

This study examined whether scripting collaboration by group roles and ground rules for helping behavior assists average-ability students during small-group learning. One hundred and sixty-four elementary school students were classified as high, average or low ability and randomly assigned to heterogeneous ability groups. Groups were assigned randomly to either scripted or unscripted collaboration condition. The results show that average-ability students who worked in scripted collaboration groups contributed significantly more to group discussions and achieved higher on the posttest scores than their control counterparts. Results also indicated that scripted collaboration affected the nature of students interaction. Scripted groups yielded higher proportions of collaborative episodes, whereas unscripted groups showed relatively more individual questioning and reasoning episodes. Practical implications are discussed and topics for further research are advanced.

6.1 Introduction

Collaborative learning denotes a situation in which two or more individuals learn with and from each other. Collaborative learning has been one of the many strategies explored in the academic learning literature (Dillenbourg, 1999; Johnson

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[2] Saleh, M., Lazonder, A.W., & De Jong, T. (submitted). Structuring collaboration in mixed-ability groups to promote verbal interaction, learning, and motivation of average-ability students. (with modifications).

& Johnson, 1999; Lazarowitz & Karsenty, 1990; Okebukola & Ogunniyi, 1984; Sharan & Shaulov, 1990; Slavin, 1996; Webb, 1989). Collaborative learning involves students working together to accomplish shared goals (Johnson & Johnson, 1999). The result is that students demonstrate superior social and communication skills, academic achievement, and are more motivated to learn than they would be if they worked alone (Johnson & Johnson, 1999).

Group composition and student ability have a differential effect on learning outcomes during collaborative learning (e.g., Lou et al., 1996; Saleh, Lazonder, & De Jong, 2005 [Chapter 5]; Webb, 1989). Low ability students often learn more by being in heterogeneous groups. Average ability students achieve more by working in homogeneous groups, and high-ability students typically perform well regardless of whether they work in heterogeneous or homogeneous groups.

Saleh et al.'s (2005) study further showed that these differences are attributable to social interaction. As homogeneous high- and average-ability groups yielded higher proportions of collaborative elaboration, learning in homogeneous groups depends on discussing the course content on the basis of equal partnership. That is, students construct a shared understanding of a given topic by building on each other's ideas, discussing the significance of personal beliefs until mutual agreement is reached (Damon & Phelps, 1989; Slavin, 1995). On the other hand, interactions between students in heterogeneous group yield more individual elaborations. The low-ability students in Saleh et al.'s study asked eight times as many questions as the average-ability students. High-ability students asked no questions at all, but provided about 75% of the explanations (both individual and collaborative elaborations). Average-ability students contributed to a mere 15% of the explanations, which barely exceeds the amount of explanations given by low-ability students (10%).

Together these findings suggest that average-ability students in heterogeneous groups do not take full advantage of collaborative learning because they are excluded from teacher-learner relationships that develop between highs and lows and are given few opportunities to participate (Webb, 1989). Even so, heterogeneous ability grouping seems the preferred way to form groups. One reason is that heterogeneous groups benefit lower achieving students by giving them access to the

intellectual resources of higher ability. Another reason is that both policymakers and teachers advocate heterogeneous ability grouping. For example, the National Council for the Social Studies (1992) has encouraged educators to support heterogeneous grouping in social studies classrooms. Observations of 30 American fifth-grade science teachers revealed that teachers tended to form heterogeneous groups in relation to the composition of their classrooms (Webb, 1997).

In view of these considerations, the present study aimed to find ways to enhance the participation of the average ability students in heterogeneous ability groups. More specifically, it was examined whether an instructional approach called scripted collaboration might bring about the desired effects. The main principle of scripted collaboration is to increase achievement by providing instructions for learners to engage in specific activities during collaboration (Weinberger, 2003). Therefore, studies about the effects of scripted collaboration usually compare groups who have been trained in applying a collaboration script with control groups which received no such scripts or training (Reiserer, Ertl, & Mandl, 2002). In the present study two types of activities were used in scripted collaboration: group roles and ground rules for collaboration.

6.2 Group roles

Creating equal opportunities for participation in group work is one of the activities that might enhance the involvement of average-ability students in heterogeneous groups. This might be achieved by assigning students to specific roles they should play during collaborative learning. Examples of such roles include leader, reader, recaller, and listener. The group roles are designed to prepare students to become active participants in group discussion (Johnson et al., 1993). Collaboration scripts typically support specific roles in order to facilitate promotive social interaction, which in turn is assumed to facilitate knowledge construction (Weinberger, 2003).

Various studies have shown the educational advantages of using group roles. O'Donnell and Dansereau (1992) developed a script structure called "MURDER". Students in this method take roles as recaller and listener. They read a section of text, and then the recaller summarizes the information while the listener provides

feedback without looking at the text. On the next text section, students switch roles. O'Donnell and Dansereau found that scripted collaboration yields higher performance on retention tests than either unscripted collaboration or individual learning. Reiserer et al. (2002) have confirmed the positive effects of scripted collaboration on students' outcomes. Other studies have shown that alternating roles is more effective than using fixed roles (Spurlin, Larson, Dansereau, & Brooks, 1985), which may be due to the fact that students remember more information from the text passages they process as recaller than as listener (Lambiotte et al., 1987).

In reciprocal teaching (Palinscar & Brown, 1984), learners are provided with a structure for comprehending text material in small groups. This structure contains several activities in a specific sequence, which are modeled by the teacher. These activities include specific text comprehension fostering strategies that the learners are expected to apply, namely questioning, summarizing, clarifying, and predicting. First, learners read the beginning section of a text. Subsequently, one learner takes the role of the teacher and asks questions about the text that should be answered by the other learner. Then the student in the teacher role tries to summarize the main ideas of the text. If necessary the learning partner completes missing subjects. Thereafter the 'teacher' identifies difficult passages of the text and tries to clear them up in collaboration with the learning partner. Finally, both learners try to predict the contents of the following text passages. Learners change teacher and learner roles for following text passages in order to assure equal involvement in collaborative knowledge construction.

Palinscar and Brown (1984) report two studies on the efficacy of this approach. Over a twenty-lesson training period, students in reciprocal teaching groups showed a steady increase in text comprehension abilities, whereas students from untrained control groups showed no significant improvement. Reciprocal teaching further yielded significant gains in students' questioning and summarizing skills. Other studies have confirmed these positive effects (Kelly, Moore, & Tuck, 1994; Miller, Miller, & Rosen, 1988).

Kagan's (1992) program of cooperative learning focused on the development of social interaction skills. He utilized roles (such as listening, turn taking, helping, and asking for help) for students to play when working in groups. He asserted that

playing those roles would have a positive effect on interaction and encourage students to participate better in group discussion. This procedure support what some researchers have found, learners who play the role of the teacher outperformed their partners who were taught the learning material (Lambiotte et al., 1987; O'Donnell & Dansereau, 2000).

However, some of the research on scripted collaboration claims that students benefit more when they are free to choose and alternate their own roles. Rewey, Dansereau, Skaggs, Hall, and Pitre (1989) found that students learn more when they generate their own scripts. Strijbos, Martens, Jochems, and Broers (2004) found a positive effect of functional roles on social interaction (but not on performance) when students distributed the roles themselves and exerted their role for the full duration of the course. When students generate their own strategies for interacting on task, they may include elements of the scripted collaboration such as: breaking the task into smaller units or asking questions about the material (O'Donnell, 1999).

Together these studies suggest that roles can promote learning and interaction. The studies also suggest ways in which roles might enhance participation of average-ability students in the group interaction. Since giving explanations appears to be more effective than receiving them, average-ability students should be encouraged to assume the "explainer" role. Another implication is that students should be able to change roles. Not only are fixed roles less productive to learning than unfixed roles, they may also reduce the chance low-ability students receive adequate answers to their questions. The present study therefore used a flexible turn-taking mechanism that alternates the role of the "explainer" on the basis of a group member's previous help-giving efforts. Its underlying principle was to temporarily limit frequent explainers' participation in order to afford low-frequency explainers' help-giving behavior. As low-ability students will ask most of the questions and high-ability students will give most explanations, this turn taking mechanism was assumed to increase the average-ability students' contributions to the group interaction.

6.3 Ground rules for collaboration

Providing a set of roles to stimulate average ability students to give explanations may not be sufficient to ensure high levels of participation. Average-ability students should also know how to participate in group discussion once given the opportunity to do so. Such guidance can be offered through "ground rules" (Mercer, Wegerif, & Dawes, 1999): guidelines to encourage the use of effective processes and interaction which help the group work together as effectively as possible.

Results of empirical studies show that ground rules have a facilitative effect on social interaction and individual knowledge acquisition. A study by King (1994) showed that ground rules prompt high-level interactions, which includes activities such as asking thought-provoking questions, integrating new knowledge with prior knowledge, and examining alternative perspectives. Students in this study were first trained to give elaborated answers. This proceeded to scaffold the students in acquisition of the skill of explaining while they continually emphasized the importance of (a) telling how and why, (b) using students own words to do so, and (c) connecting the idea being explained to something already known. Students then received training on asking prompts questions (e.g., "What does…mean?" , "Explain why…"). After training, students discussed the subject matter by asking their questions and giving elaborated answers. During these discussions, students should reciprocally construct questions with the help of the prompt cards and provide answers in small group discourse. The results of King's study showed that teaching students how to question and how to explain has positive effects on interaction and learning.

Swing and Peterson (1982) developed a two-session instructional program of discussion and giving explanations. The major focus of the first session was the enhancement of positive, task-related interaction in the group. The second training session focused on improving the explaining skills of the students. Although their program had a positive effect on students' social interaction, it did not yield higher learning gains.

Webb and Farivar (1994) adapted many of the principles of Swing and Peterson's program in their study. In addition, they used charts of behaviors for

students to engage in when they did not understand how to solve a problem (e.g., asking clear and precise questions). They compared students trained on giving help and explanation with students who received general instruction and practice in working collaboratively in groups. They found that the posttest achievement was higher in the trained conditions than in the control condition. Effects of instructional conditions on students' interaction revealed that students in the trained condition gave and received more elaboration than students in the control condition.

Mercer et al. (1999) found that teaching the students "exploratory talk" helps them to work more effectively together on tasks. "Exploratory talk is that in which partners engage critically but constructively with each other's ideas. Statements and suggestions are sought and offered for joint consideration" (Mercer et al., 1999, p.97). A set of ground rules was specified in their program to generate exploratory talk. The program requires teachers to take their class through structured lessons which raise students' awareness of how they should talk together, and guide them into the use of exploratory talk. The results showed that students who were taught to use more exploratory talk make greater gains in their individual achievement test than did students who received no such teaching.

Asking questions is considered by many to be a critical mechanism of problem solving (Davey & McBride, 1986; King, 1994, 1997). The questions and answers generated in a group help students gain new insights into the material and may increase their understanding (Webb, 1995). Several studies have shown that training students how to ask good questions can improve their understanding (King, 1994, 1997). In those studies, students were taught to generate "thinking" questions by using open-ended question starters such as "How are … and similar?" and "What do you think would happen to … if … happened?" they were also trained to use questioning in a reciprocal manner (see above).

These studies demonstrate that the nature and quality of students' discussions and learning is enhanced when they interact according to certain rules. In keeping with the nature of the interaction in heterogeneous groups, students in the present study were offered a set of ground rules for helping behavior. Ground rules for help-seeking aimed to increase the number of appropriate questions (presumably asked by the least capable group member), which in turn aimed to raise the opportunity for

the more capable group members to give explanations. The ground rules for help-giving prompted the explaining students to give explanations that are elaborated, timely, and responsive to the other student's needs (cf. Webb, 1995). The ground rules thus provide average-ability students with a safety net, explaining how they should contribute to the discussion in case they want or have to.

The study reported in this Chapter examined the effects of group roles and ground rules on average-ability students' interaction and learning in heterogeneous groups. The study compared heterogeneously grouped students whose collaboration was structured by these measures with heterogeneous groups in which collaboration was unconstrained. Students in scripted groups used the turn-taking mechanism to divide roles; prompt cards containing ground rules for help-seeking and help-giving were available to assist them in phrasing appropriate questions and explanations. As the turn-taking mechanism was to increase the average-ability students' participation in the learning dialogue, average-ability students from scripted groups were expected to contribute more often to the group discussions than average-ability students from unconstrained control groups. The ground rules were assumed to improve the quality of helping behavior in scripted groups. As the participation in and quality of interaction is associated with the quality of learning, average-ability students from scripted groups were expected to surpass their control counterparts on tests measuring learning outcomes.

The study also expands existing research by addressing the student's motivational beliefs. Although students generally enjoy working in groups, requiring students to collaborate according to a script could affect their views on collaborative learning *per se*. It is equally conceivable that students of different ability hold different perceptions of the benefits of structured collaboration. Average-ability students who believe that working in scripted groups may give them the opportunity to participate more actively in group discussion, might be more motivated to work in this instructional approach. High-ability students who believe that working in scripted groups may suffer from the roles because they can't give explanation all the time, might be more motivated to work in heterogeneous unscripted groups. Low ability students might be motivated to work in either group

as the presence of more capable peers offers them a greater chance to improve their performance.

6.4 Method

6.4.1 Participants

A sample of 164 fourth-grade students from five classes in an elementary school in Kuwait participated in the study. All students were boys between the ages of 9 and 10 years. Students classified as being of high, average, or low ability according to their performance on the Science Elementary Achievement Test (SEAT) – a standard basic science skill test in Kuwait. Scores on this test correlated .87 with pretest scores reported in Table 6.1. Students with ability scores in either the upper or lower 25 percent of the distribution scores were assigned to the high and low ability levels, respectively. Students in the middle 50 percent of the distribution composed the average ability level. Students were grouped heterogeneously into learning groups such that each group contained one high, one low, and two average ability students. Learning groups were then randomly assigned to the scripted condition (*n*=20) or to the control condition (*n*=21).

6.4.2 Instructional materials

The instruction consisted of 16 plant biology lessons. Instructional content was developed from a fourth-grade textbook and covered basic botanical topics (e.g., the parts of fruit, vegetables and flowers, their life cycle, and the way they store food) as well as advanced issues that are ill-structured and complex to fourth-graders (e.g., growing, preserving and using fruit and vegetables). All lessons applied a collaborative learning strategy that was adapted from Slavin's (1994) Student Teams and Achievement Divisions technique. Students received a brief whole-class introduction at the beginning of each lesson. Students then went to their respective groups and worked collaboratively on learning tasks receiving tutoring from their fellow group members. Students received individual scores on various individual tests (quizzes, pre- and posttest), and could earn bonus points for their groups based on their quiz scores. The team with the best score for the previous week (determined

by group performance on the task in addition to the bonus points) was acknowledged at the beginning of the week. An elaborate description of the instructional content and the collaborative learning strategy was given in Chapter 3.

Scripted collaboration groups were given two prompt cards containing the ground rules for helping behavior. These cards aimed to assist students in help seeking and help giving by outlining the steps involved in both processes. The cards were based on Farivar and Webb's (1998) sequence of effective helping skills (see Figure 6.1). The "help-seeking" card prompted students to recognize and satisfy their own information needs. It also contained question templates that were adapted from King's (1994) guided peer questioning approach. The "help-giving" card contained guidelines to help group members satisfy their information needs, including some recommendations for giving elaborate explanations. Students from scripted groups could consult the cards at all times during experimental sessions; card use was practiced during preliminary training sessions. Students from the control groups did not receive these cards, nor the associated training.

Scripted collaboration groups also received two red cards to alternate the students' roles in the learning discourse; role division in control groups was not directed by this turn-taking mechanism. The procedure for administering the red cards was based on the assumption that high-ability students would give most explanations and should be curbed in favor of the average-ability students. A student would get a red card if he took the lead in answering two separate, though not necessarily successive questions. This student would then be temporarily sidelined, meaning that he was not allowed to initiate new explanations until his red card was removed. He could however ask questions, correct or build on other student's explanations or respond to questions none of the other students could answer. The next student who started two answers or explanations received the second red card. Immediately hereafter both red cards were removed, thus maximizing the possibilities for average-ability students to participate in the discussion.

<div style="border: 1px solid">

- Recognize that you need help
- Decide to get help from one of your group mates
- Ask clear and precise questions using one of the examples below

  1. Describe…in your own words
  2. What does…mean?
  3. Why is…important?
  4. Explain why…
  5. Explain how…
  6. How are…and…similar?
  7. What is the difference between…and…?
  8. How does…affect…?
  9. What are the strengths and weaknesses of…?
  10. What causes…?
  11. How could…be used to…?
  12. What would happen if…?
  13. How does…tie in with…that we learned before?

- Keep asking until you understand

</div>

<div style="border: 1px solid">

- Notice when your group members need help
- Tell them to ask you if they need help
- Always try to help a student who asks for help
- Listen carefully to the question
- Given an explanation instead of the answer

  1. Show or tell how or why
  2. Use your own words to do so
  3. Relate the explanation to something familiar

- Watch how your group mate solves the problem
- Give specific feedback on how he solves the problem
- Check for understanding
- Praise your group mate for doing a good job

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Card containing ground rules for help seeking

Card containing ground rules for help giving

Figure 6.1 Prompt cards of helping behavior

6.4.3 Instruments

Motivational beliefs

The "How I feel about working in groups at school" questionnaire (McManus & Gettinger, 1996; see Appendix A) was administered to assess students' motivational beliefs towards collaborative learning. The 14 items of this questionnaire were grouped into three scales: (1) academic benefits, reflecting students' perceptions of their academic performance as a result of working in collaborative learning groups, such as getting better grades; (2) social benefits, reflecting students perceptions of social relationships in collaborative learning groups, such as getting to know others better; and (3) attitude benefits, reflecting students attitude toward working in collaborative learning groups, such as having fun. Items were scored on a seven-point scale ranging from 1 (never true for me) to 7 (always true for me). All scales

demonstrated satisfactory psychometric properties with internal consistency reliabilities in excess of .93.

Academic achievement

An individual pre- and posttest assessed the students' individual knowledge gains. Both tests were identical and consisted of ten items that were based on the academic objectives from Table 3.1 (see also Appendix B). The maximum score for both tests was 100 points (10 points for each item). A group assignment measured collaborative learning outcomes (see Appendix D). It consisted of three open-ended questions to stimulate all group members to contribute to the answer. The maximum score was 20 points (10 for the first item and 5 for subsequent items according to the difficulties of the answer for each item).

6.4.4 Procedure

The study was performed over a nine-week period. To assign students to groups, the SEAT test and the pretest were administered prior to the beginning of this study. Two weeks before the experiment, students in both conditions and their teacher received training course in basic skills of collaborative learning to help them work effectively in groups. This training was given by the experimenter and lasted eight lessons of 35 minutes each. Training content concerned animal biology. During the first four lessons all students carried out activities that help them to become familiar with collaborative learning. This training was based on the work of Webb and Farivar (1994) and required students to (a) carry out inclusion activities to help them become familiar with their groupmates, (b) create and discuss classroom charts of social skills, and (c) carry out activities designed to develop basic communication skills and norms for working with others in groups (e.g., listening attentively, not putting down others, using a moderate voice level, and encouraging participation) and for working on group social skills (e.g., checking for understanding, sharing ideas and information, encouraging others, and checking for agreement).

In the next four lessons, each condition continued their training separately. Students in the control condition continued the basic collaborative skills training.

The experimental groups received training in scripted collaboration. This training was based on the work of King (1994) and Farivar and Webb (1998) and taught students the use of group roles as well as training in supportive communication skills, explanation and elaboration skills, and question asking skills. After the training, participants from both groups completed the initial motivation questionnaire.

The next four weeks were devoted to the plant biology lessons. All groups attended four 35-minute lessons a week. During the treatment the scripted groups were provided with two red cards and the prompt cards. Students were forced to use the red and the prompt cards by the researcher and the class teacher while working in groups. Individual quizzes were administered every third lesson. Three assessment sessions were held following the entire instructional course. In session 1, intact learning groups were given 45 minutes to complete the group assignment. In session 2, students once again filled out the motivation questionnaire. The individual posttest was administered during the final session.

6.4.5 Coding

Academic achievement

All achievement tests were judged by two elementary science teachers to ensure representative coverage of the course content and to check student familiarity with the types of test items. The teachers also assisted in constructing an answer key for each test. Students' answers were checked against this measure and points were allocated to each response. Inter-rater agreement estimates (Cohen's Kappa) between two judges reached .88 for the pretest, .87 for the posttest, and .90 for the group assignment.

Social interaction

During the instruction each team was videotaped 3 times for approximately 10 minutes. Recordings were made randomly during the second, fifth, and eighth week. Social interaction was scored from the transcribed videotapes using a validated coding schema (Van Boxtel, 2000). First, transcripts were segmented into

utterances: a collection of words with a single communicative function. Each utterance was then categorized according to its communicative function. A distinction was made between statements, arguments, evaluations, questions, requests, proposals, confirmations, negations, repetitions, orders, and off-talk utterances.

Utterances were then grouped into episodes: a set of expressions that are meaningful at the content level. A distinction was made between question, conflict and reasoning episodes because these episodes underlay both types of elaborative talk. Question episodes contained a question (disjunctive, verification, and open) and a series of utterances that can be considered a elaborated response to that question. Short answers (e.g., "yes", "no", "the answer is 36") were not taken into account. Conflict episodes comprised negations, counter-arguments or critical questions. Reasoning episodes were defined as a sequence of utterances in which definitions, observations or hypotheses about the instructional content were related to each other. A reasoning episode contained at least one utterance that was coded as an argument.

Episodes were further classified as individual or collaborative elaboration. In case a single student answered a question, resolved a conflict or engaged in reasoning, the episode was classified as individual elaboration. When more than one student added to the conversation the episode was considered an act of collaborative elaboration.

Utterances in which the students say something about the meaning and the relations of plant concepts (statements, arguments, evaluations, questions, proposals, and negations) were considered as a type of individual contributions in group discussion.

Two raters scored the transcripts of five groups to assess inter-rater reliability. Raters first coded the utterances, and used their own classification as starting point for the scoring of episodes. Agreement scores (Cohen's Kappa) reached .85 for the utterance level and .81 for the episodic level.

6.4.6 Data Analyses

The study used a between-subject design with instructional condition (scripted, control) and ability (high, average, low) as independent variables. This 2×3 design was used to analyze individual achievement scores, contributions to episodes, and motivational beliefs. Group assignment scores and quality of interaction (i.e., number of episodes) were compared across instructional conditions. As these comparisons used the group as unit of analysis, the factor student ability could not be taken into account. All data were analyzed using analysis of variance. Where appropriate, multivariate MANOVA's preceded univariate ANOVA analyses. *Post hoc* comparisons among means were performed through Tukey tests (alpha was set at .05). Correlational analyses were conducted to examine the relationships between social interaction and academic achievement.

6.5 Results

6.5.1 Academic achievement

Pretest scores were used to determine possible differences in prior knowledge. As shown in Table 6.1, pretest scores did not differ between scripted and control groups ($F(1,158)=0.06$, $p=.81$), indicating that students from both condition were equally knowledgeable about the subject being taught. Student ability affected pretest scores ($F(2,158)=364.60$, $p<.01$). Because the interaction between instructional condition and student ability was not significant ($F(2,158)=1.05$, $p=.35$), these differences were not controlled for in the analyses.

Analysis of posttest scores produced a main effect of instructional condition in favor of the scripted groups ($F(1,158)=7.11$, $p<.05$) and a main effect of student ability ($F(2,158)=334.55$, $p<.01$). No interaction was found between group and ability ($F(2,158)=1.51$, $p=.23$), which implies that the effect of scripting on learning outcomes generalizes across ability levels. *Post hoc* comparison showed that high-ability students achieved higher scores than average and low ability students. Average-ability students achieved better than low-ability students.

Table 6.1

Means and standard deviations of individual pre- and posttest scores

Condition	Ability	Pretest	Posttest
Scripted	High (n = 20)	36.0 (5.4)	94.7 (5.7)
	Average (n = 40)	22.9 (4.3)	86.7 (6.2)
	Low (n = 20)	14.7 (3.2)	64.7 (7.5)
	Total (n = 80)	24.1 (8.4)	83.2 (12.4)
Control	High (n = 21)	34.8 (5.2)	93.3 (5.7)
	Average (n = 42)	23.7 (4.1)	82.4 (6.3)
	Low (n = 21)	14.5 (3.3)	63.4 (7.9)
	Total (n = 84)	24.2 (8.0)	80.4 (12.2)

Note. Both tests had a maximum score of 100.

Scripted collaboration did not enhance performance on the group assignment. Although the mean scores of scripted groups (M=19.3, SD=.84) were slightly higher than those of the control groups (M=18.9, SD=.87), this difference was not statistically significant ($F(1,39)$=1.93, p=.17).

6.5.2 Social interaction

Episodic level

The transcripts contained 1001 episodes: 491 for the structured groups (M=24.6, SD=1.5) and 510 for control groups (M=24.3, SD=1.6). Although there were no differences among conditions on the total number of episodes ($F(1,39)$=.29, p=.60), students in the two conditions did generate significantly different types of episodes ($F(6,34)$= 11.1, p<.01). As shown in Table 6.2, the occurrence of all episodes pertaining to collaborative elaboration differed in favor of the scripted collaboration groups. Conversely, groups in the control condition produced more individual questioning and reasoning episodes.

Table 6.2

Mean percentages and standard deviations of episodes

Type of episode	Scripted	Control	*F*
Individual elaboration			
Question episodes	24.6 (3.2)	30.1 (4.1)	21.47**
Conflict episodes	14.9 (4.3)	16.3 (3.2)	1.46
Reasoning episodes	20.1 (4.8)	23.2 (4.0)	5.11*
Collaborative elaboration			
Question episodes	14.8 (3.8)	10.1 (2.7)	21.16**
Conflict episodes	7.0 (3.2)	4.4 (3.0)	7.60**
Reasoning episodes	9.1 (3.2)	4.5 (2.3)	28.16**

Note. $N = 41$.

** $p<.01$. * $p<.05$

Table 6.3 shows the students' relative contributions to individual and collaborative episodes. Analysis of the mean number of contributions yielded multivariate main effects of condition ($F(2,157)=4.50$, $p<.05$), student ability ($F(4,316)=70.98$, $p<.01$), and a significant interaction ($F(4,316)=33.42$, $p<.01$). Figure 6.2 illustrates how the effect of instructional condition was moderated by student ability.

Table 6.3

Mean number of contributions per episode

		Type of Episode	
Condition	**Ability**	**Individual**	**Collaborative**
Scripted	High ($n = 20$)	0.42 (.06)	1.04 (.18)
	Average ($n = 40$)	0.25 (.03)	0.95 (.12)
	Low ($n = 20$)	0.08 (.04)	0.36 (.07)
Control	High ($n = 21$)	0.46 (.06)	1.43 (.21)
	Average ($n = 42$)	0.21 (.03)	0.61 (.18)
	Low ($n = 21$)	0.11 (.03)	0.49 (.13)
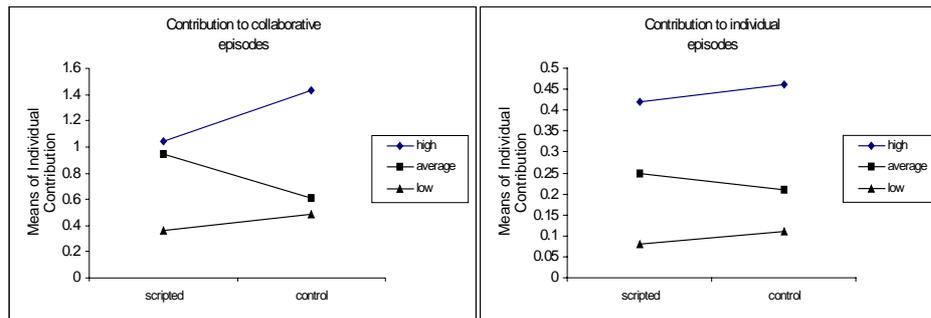
Figure 6.2 Means of individual contributions to episodes as a function of instructional condition and student ability

Tukey's pairwise comparisons for cell means showed that high-ability students from the control groups contributed more often to collaborative and individual episodes than their scripted counterparts. For average-ability students these effects were reversed: students from scripted groups showed higher contributions than students from control groups. Low-ability students in the control group had higher contributions to collaborative episodes; no effects were found for individual episodes.

Utterance level

Analyses at the utterance level were performed to shed light on the nature of the students' contribution to episodes. The analyses concentrated on the utterances that define the various types of episodes; their mean scores are displayed in Table 6.4.

A MANOVA on these measures yielded a main effect of condition ($F(6,153)=18.7$, $p<.01$), student ability ($F(12,308)=254.1$, $p<.01$) and a significant interaction ($F(12,308)=44.3$, $p<.01$). As can be inferred from Figure 6.3, univariate condition $\times$ ability interactions were significant for all utterances except negations ($F(2,158)=.03$, $p=.97$). Instructional condition did not affect this measure either ($F(1,158)= 2.48$, $p=.12$), but there was a significant effect of ability ($F(2,158)=8.44$, $p<.01$).

Tukey tests revealed that this effect arose because high-ability students produced significantly more negations than average and low-ability students.

For the other utterances, *post hoc* comparisons for cell means revealed that high-ability students from scripted groups made significantly fewer statements, arguments, and evaluations. The proportion of questions was comparable between conditions. Average-ability students in the scripted condition produced significantly higher proportions of statements, arguments, and questions than their control counterparts. The difference in proportion of evaluations was not significant. With low-ability students, the proportion of statements differed in favor of the scripted groups, whereas the proportion of questions was higher in the control groups. The other differences were not statistically significant.

Table 6.4

Mean percentages and standard deviations of types of utterances

Category	Scripted			Control		
	High (*n*=20)	**Average** (*n*=40)	**Low** (*n*=20)	**High** (*n*=21)	**Average** (*n*=42)	**Low** (*n*=21)
Statement	10.6 (0.8)	8.5 (0.8)	3.1 (0.7)	14.4 (0.9)	6.2 (1.0)	2.1 (0.6)
Argument	7.3 (1.1)	6.1 (0.9)	2.4 (0.6)	10.9 (0.9)	4.7 (0.8)	2.5 (0.6)
Evaluation	2.2 (0.9	1.3 (0.7)	0.8 (0.9)	3.6 (1.1)	0.7 (0.8)	0.6 (0.7)
Question	1.5 (0.9)	3.2 (0.9)	8.0 (0.8)	1.6 (0.6)	2.5 (0.8)	10.4 (0.7)
Proposal	2.1 (0.8)	1.5 (0.6)	0.7 (0.6)	4.3 (0.8)	0.6 (0.8)	0.7 (0.8)
Negation	1.2 (0.6)	0.7 (0.8)	0.8 (0.8)	1.0 (0.8)	0.5 (0.6)	0.6 (0.7)
Total	24.9 (1.6)	21.2 (1.6)	15.8 (1.6)	35.9 (1.0)	15.1 (1.4)	16.9 (1.3)

Correlations between participation and academic achievement

Partial correlations (controlled for pretest scores) were performed to determine if participation was related to the posttest scores. Participation was defined as the mean of student contributions to individual and collaborative episodes. Table 6.5 shows that when the three abilities are taken together, both types of episodes correlated significantly with the scores on the posttest for scripted condition. The highest correlations were found for collaborative elaboration. However, in the

control condition the only significant correlation was found with the amount of individual elaboration.
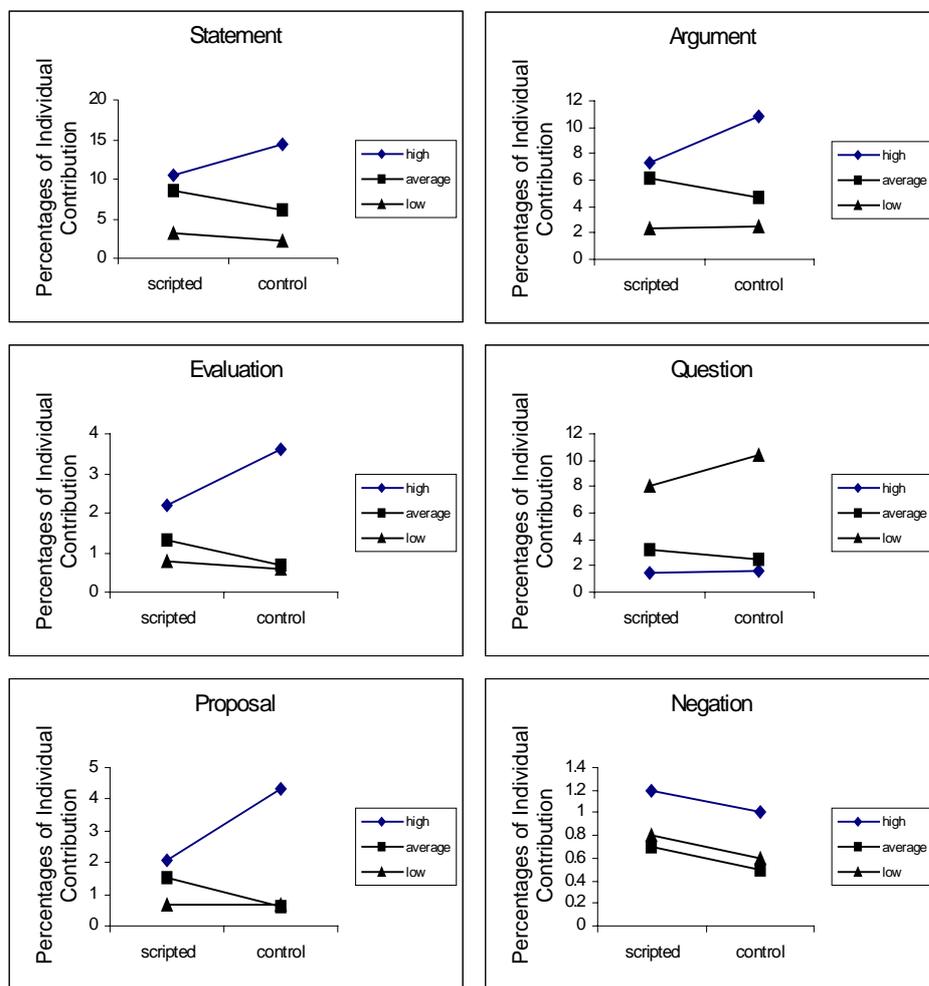
Figure 6.3 Utterance types as a function of instructional condition and student ability

Table 6.5

Partial correlations between participation and the post-test scores (controlled for pretest scores)

Condition	Ability	Type of Episode		
		Individual	**Collaborative**	**Both types**
Scripted	High (n = 20)	.22	-.09	.20
	Average (n = 40)	-.14	.26	.23
	Low (n = 20)	.27	-.06	.18
	Total (n = 80)	.34**	.60**	.74**
Control	High (n = 21)	-.02	-.08	-.18
	Average (n = 42)	-.11	.23	.18
	Low (n = 21)	-.05	.09	.05
	Total (n = 84)	.30*	.13	.30*

** p<.01. * p<.05

6.5.3 Motivational beliefs

The students' motivational beliefs towards collaborative learning were assessed before and after the instruction. The final motivation scores are displayed in Table 6.6. A MANOVA, using the initial scores as covariates, produced a main effect for instructional condition ($F(3,156)=3.28$, $p<.05$), a main effect for student ability ($F(6,314)=9.98$, $p<.01$) and a significant interaction effect ($F(6,314)=5.81$, $p<.01$). Figure 6.4 displays the overall condition × ability interaction; similar patterns were obtained for academic, social and attitude scales.

Tukey's pairwise comparisons indicated that average-ability students from scripted groups thought more positively of collaborative learning than average-ability students from control groups. No significant differences were found for high and low-ability students.

Table 6.6

Mean scores (and standard deviations) for motivational beliefs toward collaborative learning

Condition	Ability	Academic	Social	Attitude
Scripted	High (*n*=20)	4.9 (0.7)	5.4 (0.7)	5.5 (0.8)
	Average (*n*=40)	6.3 (0.6)	6.0 (0.6)	6.4 (0.6)
	Low (*n*=20)	6.2 (0.7)	5.9 (0.8)	6.5 (0.6)
Control	High (*n*=21)	5.2 (0.6)	5.4 (0.7)	5.7 (0.8)
	Average (*n*=42)	5.4 (0.8)	5.3 (0.7)	5.6 (0.6)
	Low (*n*=21)	6.1 (0.8)	6.1 (0.9)	6.1 (0.8)

6.6 Discussion

This study examined whether scripting collaboration by group roles and ground rules for helping behavior assists average-ability students during small-group learning. The results support the hypothesis that role assignment reduces inequalities in participation. Average-ability students from scripted groups contributed significantly more to group discussions than their control counterparts. Scripted collaboration also promoted average-ability students' achievement on the post-test. As these achievement gains correlate positively with contributions to episodes, it is concluded that average-ability students interact more actively and learn more when they are recurrently assigned to the "explainer" role. This conclusion is consistent with earlier findings by Lambiotte et al. (1987) and Webb (1989), who showed that individual learning outcomes are related to the amount of active participation of a student in group discussion.

An equally important outcome is that the educational advantages of scripted collaboration generalizes across ability levels. While high and low-ability students from control groups had higher contributions to the learning discourse, posttest scores differed in favor of the highs and lows from scripted groups. It thus seems

that the restrictions imposed by the turn-taking mechanism did not affect achievement outcomes of high and low-ability students. A possible explanation is that scripted collaboration affected the nature of the interaction. Scripted groups yielded higher proportions of collaborative episodes, whereas unscripted groups showed relatively more individual questioning and reasoning episodes. This implies that students in scripted groups contributed to a larger share of the episodes, which can be considered an alternative measure of active participation.
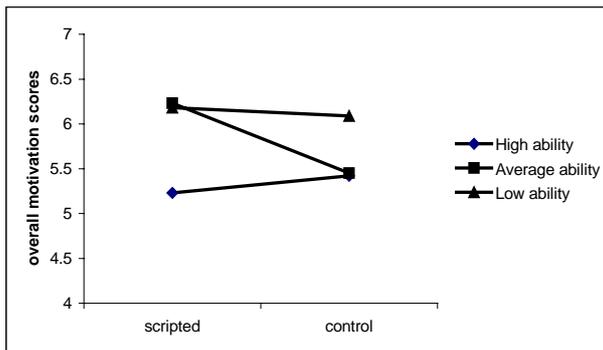
Figure 6.4 Motivational beliefs as a function of instructional condition and student ability

Contrary to expectations, the ground rules did not enhance the quality of helping behavior. Ground rules prompted students to ask high-level questions and give elaborated explanations, which would lead to more question episodes. The results are equivocal. Average-ability students in scripted groups asked more questions than their control counterparts, but for low-ability students these scores were reversed. Likewise, the number of collaborative question episodes differed in favor of the scripted groups, whereas the control groups generated more individual question episodes. The number of conflict and reasoning episodes (which also involve giving elaborated explanations) did not differ between conditions either. These results are inconsistent with the findings reported in King (1994) and Webb and Farivar (1994). A possible explanation is that participants in these studies were older, and therefore possibly more receptive to the helping prompts. Another explanation is that, as in Webb and Farivar (1994), the teacher's instructional style may have affected the

students' tendency to request and give elaborated help. Future research should validate both assumptions.

The results of present study also revealed that, compared with working in unscripted collaboration group, scripted collaboration learning has a positive effect on the motivational beliefs of average-ability students. An equally positive effect is that scripted collaboration did not lower the motivation of low and high-ability students. While this seems trivial, constraining high-ability students' natural propensity for giving explanations could have an adverse effect on their perceptions of learning in scripted groups. Furthermore, as scripted collaboration does not lower high and low-ability students' contributions to the learning discourse, and even enhances their posttest scores, it is probably fair to conclude that scripted collaboration is beneficial to all students.

Together these findings demonstrate that scripted collaboration in general, and role assignment in particular, promotes learning in heterogeneous ability groups. Elementary school teachers are therefore encouraged to supplement heterogeneous grouping practices with a self-imposed, flexible turn-taking mechanism. Other practitioners might explore whether older children, and particularly adolescents are willing to submit themselves to this turn-taking mechanism. Scholars might examine whether and how explicit role assignment can be faded. The turn-taking mechanism is an effective, yet somewhat artificially imposed means to equalize participation. It could be argued that, once average-ability students have an equal share in the group interaction, the turn-taking mechanism can be gradually removed, so that students learn to collaborate without external support. Process-oriented studies should uncover the desirability, techniques, and pace of such fading.

Future research should also examine the role of the teacher and his/her verbal interaction with the students in collaborative learning classrooms. The teacher plays a pivotal role in the collaborative learning process as it was implemented in this study. The teacher structures collaborative learning activities, forms the groups, and determines assessment tools and the ways in which they will be used. Advocates of collaborative learning recommend that teachers should monitor, facilitate, and coach students during working in groups (e.g., Johnson and Johnson, 1999; Slavin, 1994). Lack of coordination between those tasks during teaching will detract from the

effectiveness of the classroom, while adequate coordination of these tasks serves to improve classroom functioning (Hertz-Lazarowitz & Shachar, 1990, p78).

Another important task of the teacher during collaborative learning is to provide students with feedback. It is quite unclear how students benefit from teacher feedback after they finish the group task and demonstrate it to the teacher and the classmates. Johnson and Johnson (1993) proposed that the most powerful and effective source of feedback is other people. Receiving personalized feedback from another person increases performance to a greater extent than does receiving impersonal feedback (Fuller et al., 1969). Despite the teacher roles in collaborative learning has changed from transmitter of knowledge to mediator of thinking, he/she still serves as an important resource for students knowledge in that he/she still is the most knowledgeable person in the classroom.

Chapter seven

General Conclusions and Discussion

7.1 Introduction

This final Chapter will summarize the findings of the three experimental studies and present a general discussion of their main results. Furthermore, from a reflection upon these findings and the experiences gained during the studies, recommendations for introducing collaborative learning in elementary classrooms are advanced. The Chapter ends with suggestions for future research.

The goal of this thesis was to examine the following main questions:

1. *How does within-class grouping affect learning?*
2. *How can within-class grouping be improved to maximize the potential of collaborative learning for all students?*

The previous Chapters reported three experimental studies that were carried out to answer these main questions. A brief review of the studies and their rationale is given below.

7.2 Review of the studies

While collaborative learning is generally acknowledged an effective way of learning, its efficacy in Kuwait schools remained to be shown. Prompted by this lack of corroborating evidence, this thesis started out with a baseline study that aimed to assess the benefits of collaborative learning over individual learning in Kuwait elementary schools. To avoid the negative experiences encountered during previous attempts, this study utilized a well-tried collaborative learning method and created ample opportunities to familiarize the students and their teacher with collaborative learning.

The second and third study sought to answer the main questions of this thesis. The second study (Chapter 5) addressed the effects of two different types of group composition (heterogeneous and homogeneous ability groups) on academic achievement, social interaction, and motivational beliefs. It was found that group composition has a differential effect on both academic achievement and motivational beliefs, and that these effects are attributable to social interaction. Analysis of the learning dialogues revealed some interesting directions to further improve social interaction and learning of average-ability students.

These suggestions were the main focus of the third study, which is reported in Chapter 6. This study examined whether scripted collaboration in heterogeneous groups assists average-ability students during small-group learning. The collaboration scripts comprised guidelines for students to alternate roles during group work and ground rules for helping behavior. Participants in this study were assigned to a scripted collaboration condition or an unconstrained control condition. Between-condition comparisons were to shed light on the potentials of scripted collaboration to promote social interaction, academic achievement and motivation of average-ability students

7.3 How does within-class grouping affect learning?

The first study indicated that learning in heterogeneous groups yields higher achievement gains than individual learning. This conclusion applies to both individual learning outcomes and performance on a group assignment, and is consistent with the large body of literature concerning small-group and individual learning instructions (Dillenbourg, 1999; Johnson & Johnson, 1994; Lazarowitz & Karsenty, 1990; Okebukola & Ogunniyi, 1984; Sharan & Shaulov, 1990; Slavin, 1996; Webb, 1989).

While this result may seem trivial, it is important to note that this study was the first successful attempt to implement collaborative learning in Kuwait schools. There may be two reasons why this study differed from previous, unsuccessful efforts. One is that the collaborative learning method used here satisfied the conditions for successful collaborative learning outlined in Chapter 2 (see also

Gillies, 2003; Johnson & Johnson, 1990), Another reason pertains to the target audience. This study used young children (fourth graders) because they were assumed to have grown least accustomed to traditional modes of teaching and learning. They were thus presumed to adapt more easily to collaborative learning than students who have received more years of education. The generalizability of the current findings to an older population of Kuwait students remains open to challenge.

It should be noted, however, that individual achievement differences were found for open-ended test items only. On closed questions that allow for a single correct answer, no significant difference was found. As stated in Chapter 2, the gains of collaborative learning may be explained from social interaction. When students learn in groups, they explain material to each other, provide information, ask questions, engage in argumentative discussions and so on. Students thus practice the activities that are fundamental to performing tasks for which no definitive answer can be given (as in the case of the open questions).

The relationship between academic achievement and social interaction was examined in more detail in the second study. It aimed to reveal the influence of group composition on the nature of the learning discourse and, as a result, learning outcomes. Since Kuwait elementary school contain same-gender, same-ethnicity classes, this study focused on within-class ability grouping. When groups are formed on the basis of student ability, there are essentially two possibilities: groups can be composed of students who are either similar or dissimilar in ability. The nature of the students' interactions was hypothesized to differ as a function of the composition of their learning group (e.g., Webb, 1991). This was borne out by the results. Interactions in heterogeneous groups resembled a teacher-learner dialogue in which the high-ability students answered the questions of the low-ability students. The average-ability students hardly participated in the group interaction and, as a result, achieved less compared to homogeneously grouped average-ability students. When grouped homogeneously, average-ability students more often complemented and built on each other's thoughts when answering questions, resolving conflicts, or reasoning about the course content. Homogeneously grouped low-ability students engaged in relatively few productive interactions and therefore achieved less than

their heterogeneously grouped counterparts. High-ability students learned as much in either group.

Additionally, both studies revealed positive effects of collaborative learning on student motivation. In the first study, the initial motivation questionnaire scores indicated that students from both conditions (collaborative and individual learning) expected collaborative learning to be challenging. The scores of final motivation questionnaire showed an improvement in the motivational beliefs towards collaborative learning among students from collaborative learning condition only. These gains are consistent with previous findings that collaborative learning promote a positive change in student beliefs and motivation to learn (Johnson & Johnson, 1990; Slavin, 1990).

In the second study, group composition and ability had a differential effect on motivational beliefs. The final motivation scores of low-ability students from heterogeneous groups were significantly higher than the scores of homogeneously grouped low-ability students. Motivation scores for high and average-ability students did not differ across conditions, which in case of the average-ability students seems somewhat surprising. After all, they were "excluded" from the teacher learner relationships that developed between the high and low-ability students.

Together these findings indicate an overall positive effect of learning in heterogeneous groups compared to individual learning. The findings further show that heterogeneous groupings are beneficial to students of high and low ability; average-ability students appear to interact and achieve more in homogeneous groups. Thus it seems that heterogeneous grouping is the preferred way to place students in learning groups, especially because of the detrimental effects of homogeneous grouping on low-ability students. However, additional measures are needed for heterogeneous groups to be effective for average-ability students. These measures should primarily aim to increase the average-ability students' participation in the group interaction.

7.4 How can scripted collaboration improve learning?

The third study reported in Chapter 6 aimed to assess the potentials of structuring small group work to promote learning of *all* students. One of the problems described in relation to unstructured collaboration was the possibility of differential participation as a result of ability differentiation within the group. From the second study it became clear that merely training students in the basic collaboration skills (i.e., social skills and promotive social interaction) is insufficient for average-ability students to take full advantage of collaborative learning. Prompted by these results and the theoretical framework, strategies were developed to promote participation of average-ability students in group discussion. To equalize participation and stimulate the students to participate more in group discussions, a turn taking mechanism was developed. Students were also provided with ground rules for interaction. These guidelines encouraged the use of promotive social interactions which served to help the group work together as effectively as possible. In addition, an introductory training was designed to familiarize students with the turn-taking mechanism and teach them to use the guidelines for asking and giving explanations.

The result of this study showed that the joint use of the turn-taking mechanism and the ground rules for productive interaction produced the anticipated effects. Average-ability students from scripted collaboration groups participated more often in the group interaction that did average-ability students from control groups. As a consequence, average-ability students from scripted groups surpassed their control counterparts on the individual posttest. Scripted collaboration also increased the average-ability students' motivation to learn in groups.

An equally beneficial result is that scripted collaboration did not lower the scores of high and low-ability students. They showed comparable gains in academic achievement and were equally motivated to learn in scripted and unscripted groups. While this seems trivial, constraining high-ability students' natural propensity for giving explanations could have an adverse effect on their perceptions of learning in structured groups. Furthermore, as scripted collaboration did not lower high and low-ability students' contributions to the learning discourse, and even enhanced

their posttest scores, it is probably fair to conclude that structured collaboration is beneficial to all students.

7.5 Practical implications

Based on the empirical results and the experiences gained during the studies, several recommendations can be formulated to increase the effective use of collaborative learning in elementary classrooms. In following the phases of the general collaborative learning method, teachers are encouraged to take the following measures into consideration:

7.5.1 Preparing

- Select academic objectives; the first step in the collaborative learning method concerns the selection of the course content.
- Prepare students to work effectively in group; students need to know the basic skills of collaborative learning. The first time you introduce collaborative learning, its better to talk about the importance of cooperation in their lives .
- Create ground rules for collaboration. First, by training students on giving explanations instead of short answers. And second, by providing each group with prompt cards that guides students in asking for and providing help and explanations.
- Describe precisely what students are expected to learn and be able to do on their own well beyond the end of the course.
- Design an open-ended task which forces the students to engage in certain activities, such as questioning, elaborating, and co-construct each other's ideas.
- Form heterogeneous ability groups if possible (high, average, and low ability students).
- Assign students to small groups (about 4 students); in large groups not all students will participate in the discussion. The most efficient group size for attaining a goal in the least time is four to five members (Cohen, 1994).

- Arrange the classroom for group work; each group needs to be as close to their groupmates and as separated from other groups as possible.

- Give the groups time to do something fun and to get to know each other. Each group could for example make a poster containing some of the desired social skills; this will make students live in collaborative learning climate.

7.5.2 Activities and procedures of learning

- Start each lesson with a class presentation. The presentation should cover what students are about to learn and outline the components of the lesson.

- Provide each group with only one set of materials (e.g., one work-and-answer sheet) in which students have to work together and discuss the answers. This procedure creates a positive interdependence.

- Inform students that at the end of each lesson one student is randomly selected from each group to present the group's answers. This procedure creates individual accountability.

- Provide groups with a turn-taking mechanism to equalize opportunity to contribute and participate in the discussion for *all* students.

- Remind students that if they have questions, they should ask their teammates before asking the teacher.

- Provide groups with a sufficient amount of time to read, answer questions, resolve a conflict or engage in reasoning.

- Once groups are working on their tasks, it's time to walk around and monitor group performance, provide emotional support and encouragement, and encourage the students to collaborate.

- After group work, let students evaluate their group work. Important points and answers on any remaining questions posed by students must be summarized.

- After the lesson, use an individual test (e.g., quiz) that fits the learning goals. Students earn bonus points for their groups based on their quiz scores.

- After each quiz, figure individual improvement scores and team and award certificates or other rewards to high-scoring team. This may increase students' motivation to teach each other when working in groups.

7.6 Research implications

In the previous sections, some ideas were put forward to improve the effects of collaborative learning in a face-to-face situation. This section will elaborate on options for further research. The studies in this thesis encourage performing further research with different purposes and in different directions.

One suggestion for further research is to use the same materials, methods and procedures in computer-supported collaborative learning environments. Environments that offer significant user control, such as simulations and electronic communication, are rapidly gaining importance over individual computer-based learning applications. Given this shift from individual to collaborative online learning, it would be interesting to investigate whether the strategies that proved effective in the current studies will be equally effective during online collaborative learning.

Clearly, several changes may be necessary to incorporate these strategies within online learning environments. One apparent adaptation concerns the way in which ground rules are presented to students (see for example Fischer, Bruhn, Gräsel, & Mandl, 2002). A related concern is the implementation of the turn-taking mechanism. Although role playing has been studied in the context of computer-assisted learning (e.g., Sherman & Klein, 1995; Strijbos et al., 2004; Weinberger, 2003) these studies either ignored student-ability or did not compare interaction data across ability levels. Furthermore, these studies did not use a student-directed turn taking mechanism, which makes it difficult to derive hypotheses from their findings. However, given the effectiveness of the turn-taking mechanisms in face-to-face groups, it may be worthwhile to consider their implementation in collaborative online learning environments.

The focus on online learning also raises the question of whether these environments are appropriate for the present target audience. Computer-supported

collaborative learning is generally considered a rather demanding way of learning because students have to cope with the complexities of both the learning environment and the learning content. Although the user-friendliness of CSCL environments remains to improve, it may be better to examine the effects of online group roles and ground rules with secondary education students who generally are more ICT literate.

However, this poses the additional challenge of generalizing the present conclusions to a different target audience. The research reported in this thesis examined the effects of within-class ability grouping in elementary classrooms. While some effects are known to extend to older students, the benefits of the turn-taking mechanism for average-ability students has not yet been replicated. It would therefore be interesting to examine whether older students are willing to use the turn-taking mechanism and if it has a similar effect on their participation and achievement.

Replications with a different target audience are of particular importance to assess the effects of the ground rules for helping behavior. The study reported in Chapter 6 failed to confirm the findings by King (1994) and Webb and Farivar (1994) that ground rules enhance the quality of students' helping interactions. A possible explanation is that participants in these studies were older, and therefore possibly more receptive to the directions provided by the ground rules. Another explanation is that, as in Webb and Farivar (1994), the teacher's instructional style may have affected the students' tendency to request and give elaborated help. Future research should validate both assumptions.

In regards to the teacher, it may be interesting to examine his/her role during collaborative learning. This role has changed when using collaborative learning compared to the teacher's role in traditional education. In this thesis, the teacher assumed a monitoring role with minimal intervention. The shift from a traditional role as information deliverer to a role as facilitator and its effects on students learning deserved more attention in future research.

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English summary

Within the context of collaborative, small-group learning, the main focus of this thesis is on grouping practices: the ways in which teachers can divide students into learning groups.

The goal of this research was to examine and answer the main questions:

1. *How does within-class grouping affect learning?*
2. *How can within-class grouping be improved to maximize the potential of collaborative learning for all students?*

The studies that are reported in this thesis were conducted in elementary schools in the State of Kuwait. The structure of the education system in Kuwait follows a 2-4-4-4 model: two years for kindergarten (4-6 years old), four years for the elementary level (6-10 years old), four years for the intermediate level (10-14 years old), and four years for the secondary level (14-18 years old). The participants of this research were boys between ages of 9 and 10 years from the forth-grade of an elementary school. The homogeneity with regard to line originates from the fact that boys and girls are study in separate school buildings. This research looked at group composition on the basis of students ability because there is no distinction between students with regard to ethnicity.

The teaching methods in Kuwait can be characterized as following a traditional lecture with individual learning strategy. Teachers give explanation to the whole class, whereupon students work individually and silently to process the teaching material. The Kuwaiti Ministry of Education has tried to replace this "traditional" method with collaborative learning with little success. Students who learned in groups, were often found to under perform students taught with traditional learning.

These findings signal important implications for the present research. This research differed from earlier Kuwaiti attempts on a number of points. First,

teachers and students were familiarized and prepared with working collaboratively. Moreover, students were taught the importance of social interaction for learning in groups during preparatory lessons and during the experiments. Thirdly, these experiments were conducted over a longer duration. Prior research was conducted for a week, Whereas, this research was conducted over a period of six week.

The study was conducted during 24 biology lessons. 50 subjects from 2 forth-grade primary school classes participated. Students were randomly assigned to individual or collaborative learning condition. Prior to the research, students from both classes were classified into heterogeneous groups on the basis of their biology grades. Each of the 5 groups consisted of 5 students: 1 high, 1 low, and 3 average ability students.

During the first week students from both conditions attended preparatory training in collaborative learning. This introduction served to familiarize students (and their teacher) with collaborative learning basic skills. The next six weeks were devoted to plant biology lessons. All groups attended four 35-minute lessons a week. Students in the collaborative learning condition worked in groups during these lessons. After a brief entire class instruction at the beginning of each class they moved to their respective groups and worked on tasks while receiving tutoring from their fellow group members. Students in the individual learning condition studied the same teaching material in a different way. They received more information and explanations from the teacher and worked individually on tasks.

From the results of this study, it became clear that collaborative learning has positive effects on learning performance. Students from collaborative learning condition gained significantly higher scores on the individual posttest. Students from collaborative learning condition gained also higher scores on the four progress quizzes and performed better on the group assignment. From the analysis of the video recordings during group work, it's became clear that the participation of students in the group discussion was higher in the collaborative learning condition than in the individual learning condition. Moreover, students in the collaborative learning condition participated more actively in the group discussion in that they produced significantly more utterances than the control group students. Collaborative learning students also showed higher degrees of productive interaction

skills (i.e., statements, arguments, evaluations, questions, proposals, and confirmations). Finally, the results revealed that collaborative learning has beneficial effects on the students' motivational beliefs. The scores on the final motivation questionnaire showed an improvement in the motivational beliefs towards collaborative learning for students from the collaborative learning condition.

In the second study the effects of group composition were examined more closely. There are two possibilities for forming groups based on learning outcomes; groups can be composed of students who are similar in ability (homogenous) or dissimilar in ability (heterogeneous). That is, the extent to which students of high, average and low ability benefit from collaborative learning depends on whether they are assigned to homogeneous or heterogeneous ability groups. Low ability students learn more in heterogeneous groups than in homogeneous groups; average ability students learn more in homogeneous groups and high ability students learn as much in both groups. This study examined whether and how these differences in learning outcomes relate to the differences in the social interaction during collaborative learning.

Participants of this study were 104 fourth-grade students in elementary school. They were classified as "high", "average" and "low ability" according to their performance on the Science Elementary Achievement tests - a standard basic science skills test in Kuwaiti primary school. This group formation process yielded 13 homogeneous and 13 heterogeneous groups. Each homogeneous group consisted of four students with the same level of ability (high, average, or low); the heterogeneous groups consisted of one high ability student, one low ability student, and two average ability students.

The set-up and the instruments of this study were nearly identical to those of the first experiment. The most important difference concerned an extension of the collaborative learning preparation from four to eight lessons and registering of the social interaction during the lessons (instead of during the group assignment). During the 16 biology lessons students from both conditions worked in their groups.

The results showed the expected effect of group composition on learning outcomes. Individual posttest scores demonstrated significant benefits of

heterogeneous grouping for low ability students. However, learning in homogeneous groups appeared to be more effective for average ability students, whereas high ability students learn as much in either group. The results of the group assignment showed the next picture: Heterogeneous groups achieved better than homogeneous groups of average and low ability students. No difference was found between heterogeneous groups and homogeneous groups of high ability students.

The results of the social interaction analysis also showed differences between heterogeneous and homogeneous groups. Homogeneous groups produced relatively more collaborative episodes: in which two or more students participated in answering a question, resolved a conflict, or engaged in reasoning. This means that students of similar ability more often complement and build on each other's ideas than students of dissimilar ability. Moreover, as collaborative episodes correlate positively with achievement gains, learning in homogeneous groups depends on discussing the course content on the basis of equal partnership. However, these conclusions do not apply to low-ability students who, in absence of more capable peers, give and receive very few elaborated explanations among themselves.

Heterogeneous grouping arrangements yield relatively more individual elaborations. An individual episode was defined as a single student answering a question, resolving a conflict, or engaging in reasoning.

Closer analysis of these interactions indicated that the social interaction in heterogeneous groups resembles a teacher-learner dialogue. Low-ability students asked eight times as many questions as average-ability students. High-ability students asked no questions at all, but provided about 75% of the explanations. Average ability students hardly participated in these conversations. They contributed to a mere 15% of the explanations, which barely exceeds the amount of explanations given by low-ability students (10%). This in turn might explain why learning gains in heterogeneous groups were not associated with individual elaborations.

As with learning outcomes, group composition has a differential effect on students' motivational beliefs. From the results of the motivation questionnaire it became clear that low ability students are more motivated to learn in heterogeneous groups; the ratings of average and high ability students do not differ as a function of

group composition. Can be concluded that composition makes no difference for these students.

The most important conclusion of this study was that no one of both group compositions has a clear preference. For high ability students the composition of the group actually makes no difference. Homogeneous groups however, seem the best option for average ability students, whereas heterogeneous groups offer clear advantages for low ability students. As intact classrooms consist mainly of average achievers, teachers prefer grouping practices that, ironically, tend to inhibit the majority of their students. The effectiveness of heterogeneous groups could be improved considerably with methods found to enhance the participation of the average ability students in group discussion.

The third experiment examined to what extent group roles and ground rules can improve the participation of the average ability students in heterogeneous groups. Because the interaction in heterogeneous groups mostly adopts the form of teacher-learner conversation, this study tried to enhance the involvement of average ability students in answering questions from their low ability groupmates. For this purpose a flexible turn-taking mechanism was introduced. The functioning of this procedure relied on the data that shows that high ability students answered the most questions from low ability students. The principle of the turn-taking mechanism was to temporarily limit frequent explainers' participation in order to afford low-frequency explainers' help-giving behavior. As low-ability students will ask most of the questions and high-ability students will give most explanations, this turn taking mechanism was assumed to increase the average-ability students' contributions to the group interaction.

To examine the effects of group roles and ground rules on students interaction and learning outcomes, two conditions were compared. Heterogeneous groups from the experimental condition were trained to use the group roles and the ground rules for collaboration; the heterogeneous groups from the control condition received training on basic communication skills only. Average ability students from scripted groups were expected to contribute more often to the group discussions than average-ability students from unconstrained control groups. Therefore, they were

expected to surpass their control counterparts on tests measuring learning outcomes. Moreover it was expected that average ability students from the experimental group would be more motivated for working in groups after the training lessons.

A sample of 164 fourth-grade students from five classes in an elementary school participated in the study. Analogously to the second study the students were classified as being of high, average, or low ability according to their performance level. Students were grouped heterogeneously into learning groups such that each group contained one high, one low, and two average ability students. Learning groups were then randomly assigned to the scripted condition (n=20) or to the control condition (n=21).

The set-up and the instrument of this study were nearly identical to those of second study. The most important differences concerned the use of the turn-taking mechanism and the ground rules. The experimental groups practiced the use of these activities during the last four training lessons (the first four lessons was the same for both conditions). During the 16 biology lessons the experimental groups were provided with two red cards and prompt cards. Students were forced to use the red and the prompt cards by the researcher and the class teacher while working in groups.

The results support the hypothesis that role assignment reduces inequalities in participation. Average-ability students from the experimental group contributed significantly more to group discussions than their control counterparts. The experimental condition also promoted average-ability students' achievement on the posttest. Average ability students were also found to be more motivated to work in groups. From the significant correlation between learning outcomes and participation it becomes clear that individual learning outcomes are related to the amount of active participation of a student in group discussion.

An equally positive effect is that scripted collaboration did not lower the motivation of low and high-ability students. While this seems trivial, constraining high-ability students' natural propensity for giving explanations could have an adverse effect on their perceptions of learning in scripted groups. Furthermore, as scripted collaboration did not lower high and low-ability students' contributions to

the learning discourse, and even enhanced their posttest scores, it is probably fair to conclude that scripted collaboration is beneficial to all students.

Experimental groups yielded higher proportions of collaborative episodes, whereas control groups showed relatively more individual questioning and reasoning episodes. This implies that students in the experimental groups contributed to a larger share of the episodes, which can be considered an alternative measure of active participation.

Contrary to expectations, ground rules did not enhance the quality of helping behavior. Ground rules prompted students to ask high-level questions and give elaborated explanations, which lead to more question episodes. The results are equivocal. Average-ability students in scripted groups asked more questions than their control counterparts, but for low ability students these scores were reversed. Likewise, the number of collaborative question episodes differed in favor of the experimental groups, whereas the control groups generated more individual question episodes. The number of conflict and reasoning episodes (which also involved giving elaborated explanations) did not differ between conditions either.

The general conclusion from this study is that structuring the interaction was beneficial for average ability students. Meanwhile, the activities of group roles and ground rules did not lower high and low-ability students' contributions to the learning discourse, and even enhances their posttest scores, it is probably fair to conclude that scripted collaboration is beneficial to all students.

At the beginning of this summary two research questions were presented. The answer of the question " *how does within-class grouping affect learning?* is given in the first two studies. From study 1 it became clear that (heterogeneous) group learning was more effective than individual learning. The results of the second study show that heterogeneous groupings are beneficial to students of high and low ability; but that average ability students appear to interact and achieve more in homogeneous groups.

To overcome the negative effect of the grouping on average ability students became the focus of the 2nd research question. From study 3 it became clear that the joint use of the turn-taking mechanism and the ground rules for productive

interaction produced the anticipated effects. In heterogeneous groups in which this procedure was used, the average ability students participated more often in the group interaction, gained higher learning outcomes and were more motivated to learn in groups. In addition, the ground rules for collaboration did not enhance the quality of students' helping interactions. The functioning and effectiveness of these rules are an interesting subject for future research.

Dutch summary

Dit proefschrift beschrijft een onderzoek naar de samenstelling van groepen bij samenwerkend leren in het basisonderwijs. De vraagstelling die aan dit onderzoek ten grondslag ligt, is tweeledig:

1. *Hoe beïnvloeden groepsvorming en groepssamenstelling het leerproces en de leerprestaties?*
2. *Hoe kunnen eventuele negatieve effecten van het vormen van groepen worden ondervangen, zodat alle leerlingen zo optimaal mogelijk kunnen profiteren van samenwerkend leren?*

Het onderzoek bestaat uit een literatuurstudie en drie experimenten die zijn uitgevoerd op basisscholen in Koeweit. Het onderwijssysteem in Koeweit is opgezet volgens een 2-4-4-4 model: twee jaar kleuteronderwijs (4–6 jaar), vier jaar onderbouw basisonderwijs (6–10 jaar), vier jaar bovenbouw basisonderwijs (10–14 jaar), en vier jaar voortgezet onderwijs (14–18 jaar). De deelnemers aan dit onderzoek waren jongens van 9 en 10 jaar uit de vierde klas van het basisonderwijs. De homogeniteit qua geslacht komt voort uit het feit dat scholen in Koeweit aparte jongens- en meisjesklassen hebben. Omdat deze klassen eveneens homogeen zijn voor wat betreft etnische herkomst, is in dit onderzoek gekeken naar groepssamenstelling op basis van leerlingprestaties.

De onderwijsmethode in Koeweit kan gekenmerkt worden als docentgestuurd en individueel. Leerkrachten geven uitleg aan de gehele klas, waarna leerlingen individueel en in stilte de lesstof verwerken. In opdracht van het Koeweitse Ministerie van Onderwijs is geprobeerd deze "traditionele" manier van onderwijzen te vervangen door samenwerkend leren. Deze pogingen waren weinig succesvol: leerlingen die in groepjes leerden, presteerden minder dan leerlingen die dezelfde leerstof op de traditionele manier hadden geleerd.

Deze bevindingen staan haaks op de uitkomsten van eerder onderzoek naar de effectiviteit van samenwerkend leren. Zij vormden tevens de aanleiding voor het eerste experiment waarin samenwerkend leren werd vergeleken met individueel leren. Dit onderzoek verschilde op een aantal punten van de hierboven genoemde eerdere Koeweitse pogingen. Ten eerste werden zowel de leerkracht als de leerlingen grondig voorbereid op samenwerkend leren. Daarnaast werden leerlingen tijdens deze voorbereidende lessen én tijdens het experiment gewezen op het belang van sociale interactie voor het leren in groepen. Een derde verschil betrof de tijdsduur van het experiment: deze werd verlengd van één week naar zes weken.

Het onderzoek werd uitgevoerd tijdens 24 biologielessen. De proefpersonen waren 50 leerlingen uit twee vierde klassen uit de onderbouw van het basisonderwijs. Leerlingen uit de ene klas vormden de samenwerkend leren conditie; leerlingen uit de andere klas vormden de individueel leren conditie. Voorafgaand aan het onderzoek werden de leerlingen uit beide klassen ingedeeld in heterogene groepen op basis van hun rapportcijfer voor biologie. Elke groep bestond uit 5 leerlingen: 1 relatief goed presterende leerling, 1 relatief slecht presterende leerling en 3 gemiddeld presterende leerlingen.

Tijdens de eerste week van het experiment volgden de leerlingen uit beide klassen vier voorbereidende lessen waarin de basisvaardigheden in het samenwerkend leren werden geoefend. In de zes weken daarna kregen de leerlingen vier biologielessen per week. Leerlingen in de samenwerkend leren conditie werkten tijdens deze lessen in hun groepjes. Na een korte uitleg van de leerkracht werkte elk groepje aan taken en opdrachten, waarbij de groepsleden elkaar konden helpen bij het begrijpen en verwerken van de leerstof. Leerlingen uit de individueel leren conditie bestudeerden dezelfde lesstof op een andere manier. Zij kregen meer uitgebreide uitleg van hun leerkracht en werkten individueel aan taken en opdrachten.

Uit de resultaten van dit onderzoek bleek dat samenwerkend leren een positief effect heeft op de leerprestaties. Leerlingen uit de samenwerkend leren conditie behaalden significant hogere scores op een individuele posttest, die na afloop van de biologielessen werd afgenomen. Leerlingen uit de samenwerkend leren conditie behaalden eveneens hogere scores op vier voortgangstoetsen en presteerden beter op

de afsluitende groepsopdracht. Uit analyse van video-opnames tijdens de groeps-opdracht bleek dat participatie van leerlingen in de groepsdiscussie hoger was in de samenwerkend leren conditie dan in de individueel leren conditie. Bovendien bleek dat de gesprekken van leerlingen uit de samenwerkend leren conditie naar verhouding meer leergerichte interacties bevatten (d.i. stellingen, argumenten, evaluaties, vragen, voorstellen en bevestigingen). Tot slot bleek dat leerlingen uit de samenwerkend leren conditie aan het eind van het experiment meer gemotiveerd waren om in groepjes te leren dan leerlingen uit de individueel leren conditie.

In het tweede experiment is de invloed van de samenstelling van de groep nader onderzocht. Bij groepssamenstelling op grond van leerprestaties zijn er globaal gezien twee mogelijkheden: groepen kunnen bestaan uit leerlingen die gelijk presteren (homogene groepen) of uit leerlingen die verschillend presteren (heterogene groepen). Uit onderzoek is gebleken dat leerlingen met verschillende prestatieniveaus in verschillende mate profiteren van leren in heterogene en homogene groepen. Slecht presterende leerlingen leren meer in heterogene groepen dan in homogene groepen; gemiddeld presterende leerlingen leren juist meer in homogene groepen en goed presterende leerlingen leren evenveel in beide groepen. In dit experiment is onderzocht of en hoe deze verschillen in leerprestaties samenhangen met verschillen in sociale interactie.

Deelnemers aan dit onderzoek waren 104 vierdeklassers uit de onderbouw van het basisonderwijs. Zij werden geclassificeerd als "goed presterend", "gemiddeld presterend" en "slecht presterend" op basis van hun scores op de *Science Elementary Achievement Test* – een veelgebruikte toets in het Koeweitse basisonderwijs. Vervolgens werden 13 homogene en 13 heterogene groepen gevormd. De homogene groepen bestonden uit vier leerlingen met hetzelfde prestatieniveau (goed, gemiddeld, of slecht); de heterogene groepen werden gevormd door één goed presterende leerling, één slecht presterende leerling en twee gemiddeld presterende leerlingen.

De opzet en het instrumentarium van dit onderzoek waren vrijwel identiek aan die van het eerste experiment. De belangrijkste verschillen betroffen een uitbreiding van de voorbereiding in samenwerkend leren van vier naar acht lessen en het

registreren van sociale interactie tijdens de lessen (in plaats van tijdens de groepsopdracht). Tijdens de 16 biologielessen werkten de leerlingen uit beide condities in hun groepjes.

De resultaten toonden het verwachte effect van groepssamenstelling op leerprestaties. Op de individuele posttest scoorden slecht presterende leerlingen uit heterogene groepen beter dan slecht presterende leerlingen uit homogene groepen. Voor gemiddeld presterende leerlingen was de uitkomst precies andersom terwijl de goed presterende leerlingen uit beide condities even hoog scoorden. De resultaten van de groepsopdracht lieten het volgende beeld zien: Heterogene groepen behaalde betere resultaten dan homogene groepen met gemiddeld en laag presterende leerlingen. Er werd geen verschil gevonden tussen heterogene groepen en homogene groepen met goed presterende leerlingen.

Uit de resultaten bleek verder dat heterogene en homogene groepen op een verschillende manier discussiëren over de leertaak. Homogene groepen produceren relatief meer collaboratieve episodes: samenhangende reeksen leergerichte interacties waarin twee of meer leerlingen participeren. Dit betekent dat leerlingen van gelijk niveau meer geneigd zijn op elkaars uitspraken te reageren dan leerlingen van verschillend niveau. Bovendien blijkt er een verband te bestaan tussen het percentage collaboratieve episodes en de prestaties op de individuele posttest. Deze conclusies gelden echter niet voor homogene groepen van slecht presterende leerlingen. In deze groepen was het percentage collaboratieve episodes laag en niet verschillend van het percentage collaboratieve episodes in heterogene groepen.

In heterogene groepen werden relatief meer individuele episodes gevonden. Een individuele episode werd gedefinieerd als een samenhangende reeks leergerichte interacties waarin slechts één leerling participeert. Nadere analyse van deze interacties wees uit de dat dialogen in heterogene groepen sterke overeenkomsten vertonen met een onderwijsleergesprek waarin de slecht presterende leerlingen vragen stellen die door de goed presterende leerlingen worden beantwoord. De gemiddeld presterende leerlingen namen nauwelijks deel aan deze gesprekken. Zij stelden zelden een vraag en droegen in slechts 15% van de gevallen bij aan het antwoord op vragen van de slecht presterende leerling uit hun

groep. Opmerkelijk was verder dat het percentage individuele episodes niet correleerde met prestaties op de individuele posttest.

De opvattingen van leerlingen over samenwerkend leren bleken eveneens te verschillen. Uit de scores op een motivatievragenlijst bleek dat slecht presterende leerlingen uit heterogene groepen een positiever beeld hadden van samenwerkend leren dan slecht presterende leerlingen uit homogene groepen. Gemiddeld en goed presterende leerlingen hadden een lichte voorkeur voor leren in homogene groepen, maar deze verschillen waren niet statistisch significant. Hieruit kan geconcludeerd worden dat het voor deze leerlingen geen verschil maakt of zij in heterogene of homogene groepen leren.

De belangrijkste conclusie uit dit onderzoek is dat geen van beide groepssamenstellingen een duidelijke voorkeur geniet. Voor goed presterende leerlingen maakt de samenstelling van de groep feitelijk geen verschil. Het vormen van homogene groepen lijkt echter de beste optie voor gemiddeld presterende leerlingen, terwijl heterogene groepen duidelijke voordelen bieden voor slecht presterende leerlingen. Vanuit ethische overwegingen lijkt dit laatste argument het zwaarst te wegen, zodat een lichte voorkeur voor heterogene groepen ontstaat. Een bijkomend argument is dat de effectiviteit van heterogene groepen aanzienlijk zou kunnen worden verbeterd wanneer er manieren gevonden worden waardoor gemiddeld presterende leerlingen meer gaan participeren in de interactie.

In het derde experiment is onderzocht in hoeverre het toekennen van rollen de participatie van gemiddeld presterende leerlingen in heterogene groepen kan verbeteren. Omdat de interactie in heterogene groepen veelal de vorm aanneemt van een onderwijsleergesprek, is geprobeerd de gemiddeld presterende leerlingen vaker te betrekken bij het beantwoorden van vragen van hun slecht presterende groepsgenoot. Hiertoe werd een flexibele rolverdelingsprocedure geïntroduceerd. De werking van deze procedure berustte op het gegeven dat de meeste vragen van de slecht presterende leerling door de goed presterende leerling worden beantwoord. Door het aandeel van de goed presterende leerling in het beantwoorden van vragen enigszins aan banden te leggen, werden de gemiddeld presterende leerlingen ertoe aangezet vaker op de vragen van de slecht presterende leerling te reageren. Om er

voor te zorgen dat de slecht presterende leerlingen goede vragen zouden stellen én gemiddeld presterende leerlingen wisten hoe zij deze vragen moesten beantwoorden, kregen de groepen bovendien een aantal basisregels voor het stellen van vragen en het geven van antwoorden.

Om de werking van de rolverdelingsprocedure en de basisregels te onderzoeken werden twee condities vergeleken. Heterogene groepen uit de experimentele conditie werden getraind in en maakten gebruik van de rolverdelings- procedure en de basisregels; de heterogene groepen uit de controle conditie kregen deze hulpmiddelen niet en waren vrij de samenwerking binnen de groep naar eigen inzicht vorm te geven. De verwachting was dat gemiddeld presterende leerlingen uit de experimentele conditie beter zouden presteren dan gemiddeld presterende leerlingen uit de controle conditie omdat zij naar verhouding vaker zouden participeren in de groepsinteractie. Bovendien werd verwacht dat gemiddeld presterende leerlingen uit de experimentele groep na afloop van het experiment meer gemotiveerd zouden zijn voor het werken in groepen.

Het experiment werd uitgevoerd met 164 vierdeklassers uit de onderbouw van het basisonderwijs. Analoog aan het tweede experiment werden de leerlingen op grond van hun prestatieniveau geclassificeerd als "goed presterend", "gemiddeld presterend" en "slecht presterend". Vervolgens werden heterogene groepen gevormd van één goed presterende leerling, één slecht presterende leerling en twee gemiddeld presterende leerlingen. Deze groepen werden willekeurig toegewezen aan de experimentele conditie (n=20) en de controle conditie (n=21).

De opzet en het instrumentarium van dit onderzoek waren vrijwel identiek aan die van het tweede experiment. De belangrijkste verschillen betroffen het gebruik van de rolverdelingsprocedure en de basisregels. Groepen uit de experimentele conditie oefenden het gebruik van deze hulpmiddelen tijdens de laatste vier voorbereidingslessen (de eerste vier lessen waren gelijk voor beide condities). Tijdens de 16 biologielessen waren de experimentele groepen verplicht de rolverdelingsprocedure en de basisregels te gebruiken. Beide hulpmiddelen werden niet geoefend noch gebruikt door groepen uit de controle conditie.

Uit de resultaten bleek dat de rolverdelingsprocedure het gewenste effect heeft. Gemiddeld presterende leerlingen uit de experimentele conditie participeerden meer

in de groepsgesprekken dan gemiddeld presterende leerlingen uit de controle conditie. Zij presteerden bovendien beter op de individuele posttest en waren meer gemotiveerd om in groepjes te werken. Uit de significante correlatie tussen leerprestaties en participatie blijkt bovendien dat gemiddeld presterende leerlingen meer interacteren en meer leren wanneer ze ertoe aangezet worden vragen van groepsgenoten te beantwoorden.

Een minstens zo belangrijk resultaat was dat de rolverdelingsprocedure geen negatief effect heeft op de overige leerlingen in de groep. Hoewel goed en slecht presterende leerlingen uit de controle conditie meer participeerden in de interactie, waren de resultaten op de posttest hoger voor goed en slecht presterende leerlingen uit de experimentele groep. De scores op de motivatievragenlijst lieten geen verschillen zien tussen de condities, hetgeen betekent dat het voor deze leerlingen geen verschil maakt of hun samenwerking al dan niet wordt gestructureerd door een rolverdelingsprocedure en basisregels.

Het gebruik van de basisregels had nauwelijks effect op de kwaliteit van de interactie. Deze regels zouden het stellen van goede vragen en het geven van uitgebreide antwoorden moeten stimuleren. Hierdoor werd verwacht dat groepen uit de experimentele conditie meer collaboratieve en individuele vraag-antwoord episodes zouden genereren. Dit bleek slechts ten dele het geval te zijn. Gemiddeld presterende leerlingen uit experimentele groepen stelden meer vragen dan gemiddeld presterende leerlingen uit controle groepen. Voor slecht presterende leerlingen was dit precies omgekeerd. Verder was het percentage collaboratieve vraag-antwoord episodes hoger in de experimentele conditie, maar werden meer individuele vraag-antwoord episodes gevonden in de controle conditie.

De algemene conclusie uit dit experiment is dat het structureren van de interactie duidelijke voordelen biedt voor gemiddeld presterende leerlingen. Doordat de rolverdelingsprocedure en de basisregels geen nadelige invloed hebben op de leerprestaties en motivatie van goed en slecht presterende leerlingen, kan bovendien geconcludeerd worden dat deze hulpmiddelen een positieve bijdrage leveren aan de algehele effectiviteit van het leren in heterogene groepen.

Aan het begin van deze samenvatting werden twee onderzoeksvragen gepresenteerd. Het antwoord op de vraag naar de invloed van het vormen van groepen op het leerproces en de leerprestaties wordt gegeven in de eerste twee experimenten. Uit experiment 1 blijkt dat leren in (heterogene) groepen effectiever is dan docentgestuurd, individueel onderwijs. De resultaten van het tweede experiment laten zien dat heterogene groepen niet voor elke leerling even geschikt zijn. Gemiddeld presterende leerlingen hebben de neiging zich aan de interacties in de groep te onttrekken, waardoor zij minder leren in heterogene groepen dan in homogene groepen.

Het ondervangen van deze negatieve effecten vormt de kern van de tweede onderzoeksvraag. Uit experiment 3 blijkt dat een rolverdelingsprocedure hiertoe goede mogelijkheden biedt. In heterogene groepen waarin deze procedure werd gebruikt, participeerden de gemiddeld presterende leerlingen vaker in de interactie, behaalden hogere leerprestaties en waren meer gemotiveerd voor samenwerkend leren. De eveneens in dit experiment onderzochte basisregels voor het stellen van vragen en geven van antwoorden leidden niet tot de verwachte toename in kwaliteit van de interactie. De werking en effectiviteit van deze regels is een interessant onderwerp voor vervolgonderzoek.

Appendix A

Motivation Questionnaire

How I feel about working in groups at school

Dear student:

This questionnaire contains difference statements describing feeling about working collaboratively in-group.

Please look at the example first then read each of the statement and mark with a circle on the right side whether its never true for you (1) or always true for you (7) that it actually represent the feeling about working collaboratively in group.

Since there is no right or wrong answer, please mark the column that exactly describes your feeling about learning in a group. Do not sign your name. Your answer will not be available to the teacher and will note be used for grading.

Thank you very much for your cooperation.

Mohammad Saleh

Example

Outcome	Never true for me				Always true for me		
I like science subject	1	2	3	4	5	6	7

If you like science subject you have to circle number 7. If you don't like science subject, you have to circle number 1. Circling number 4 means that your feeling about liking and unlike the science subject is equal (50 % for each feeling). That mean you can circle 2 or 3 points if you like science subject less than 50 % and 5 or 6 points if you like science subject more than 50 % but not always.

No.	Outcome	Never true for me				Always true for me		
1	It's harder for me to learn in a group	1	2	3	4	5	6	7
2	I think I don't learn as well in a group as a lone.	1	2	3	4	5	6	7
3	It's easier to talk to kids when working in a group.	1	2	3	4	5	6	7
4	I really like to hear what others think while working in a group.	1	2	3	4	5	6	7
5	I get to know other kids better by working in a group.	1	2	3	4	5	6	7
6	When working in a group, I like other kids that are in my group.	1	2	3	4	5	6	7
7	I don't know what to do while working in a group.	1	2	3	4	5	6	7
8	Other kids don't listen to me while working in a group.	1	2	3	4	5	6	7
9	When working in a group, I like to help other kids that are in my group.	1	2	3	4	5	6	7
10	It's boring to work in a group.	1	2	3	4	5	6	7

11	It is fun to work with other kids in a group.	1 2 3 4 5 6 7
12	I think I will get better grades when I learn in a group.	1 2 3 4 5 6 7
13	When working in groups, the kids in my group don't get along.	1 2 3 4 5 6 7
14	I think its takes longer to get work done in a group.	1 2 3 4 5 6 7

Note. A higher score was explained as a positive attitude towards learning in-groups. To calculate the 'attitude' score the scale on the items 1, 2, 6, 7, 8,10, and 14 has to be reversed.

Appendix B

Academic Achievement Post-test

The Plants Unit

Course: Science

Name: ………………..

Class: 4 / …...……

Group No. …………..

Please answer the following questions as best you can drawing on the knowledge you have learned in the Plant Unit. You may not work together on this test. If you need more space you can write behind the papers.

    Good luck.

People use plants for different uses. Explain the uses of plants.

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

Different fruits have different kinds of seeds. Make a comparison between three different kinds of fruit seeds.

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

Which do you think is best: growing plants in a greenhouse or in the open air? Explain your answer.

…………………………………………………………………………………

…………………………………………………………………………………

…………………………………………………………………………………

Plants like other life need food to live. Use this idea to help you answer the following question: What do you think plant need to make its food? Explain from where and how the plant can get these needs?

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…………………………………………………………………………………

…………………………………………………………………………………

Do you think tomato is a fruit or a vegetable? Explain your answer then try to write a definition for each of them.

…………………………………………………………………………………

…………………………………………………………………………………

…………………………………………………………………………………

The plant like other life needs to preserve the redundant food. Use this idea to explain where you think plant preserve food.

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…………………………………………………………………………………

…………………………………………………………………………………

Ali is a farmer. He grows date palms and sells them on the market. Therefore, he wants to get as much date palm as possible. What do you think is the best way for Ali to propagate these palms?

…………………………………………………………………………………

…………………………………………………………………………………

…………………………………………………………………………………

The plant has organs that help him to do different functions. If your teacher asks you to write a report about plant organs and the functions of each of them, what you will say?

…………………………………………………………………………………

…………………………………………………………………………………

…………………………………………………………………………………

Mohammad has bought food on the market. When he got home, he immediately ate some of it. The rest he wants to keep for tomorrow. What do you think is the best way for Mohammad to preserve his food? Explain your answer.

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a) Is it possible to grow tomato on the moon? Explain your answer.

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…………………………………………………………………………………

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b) Is it possible to grow tomato in the water? Explain your answer.

…………………………………………………………………………………

…………………………………………………………………………………

…………………………………………………………………………………

c) Is it possible to grow olive in Kuwait? Explain your answer.

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…………………………………………………………………………………

Appendix C

Individual Quizzes

Quiz 1

Date ………………..
Student name……………………..
Class 4 / …………….
Group No. ………………

Is it possible to grow tomatoes on the North pole? Explain your answer.

………………………………………………………………………………
………………………………………………………………………………
………………………………………………………………………………
………………………………………………………………………………
………………………………………………………………………………

Quiz 2

Date ………………..
Student name……………………..
Class 4 / …………..
Group No. ………………

You have studied that the environment has effects on plants organs shape.

What do you think these organs are look like in Kuwaiti environment?
Explain your answer.

………………………………………………………………………………
………………………………………………………………………………
………………………………………………………………………………
………………………………………………………………………………
………………………………………………………………………………
………………………………………………………………………………

Quiz 3

Date ………………..
Student name……………………..
Class 4 / ………..
Group No. ………………

How do you think

1. Kuwaiti's preserved their food in the past? Explain your answer.
…………………………………………………………………………………
…………………………………………………………………………………
…………………………………………………………………………………
…………………………………………………………………………………

2. Eskimo's preserve their food? Explain your answer.
…………………………………………………………………………………
…………………………………………………………………………………
…………………………………………………………………………………
…………………………………………………………………………………

Quiz 4

Date ………………..
Student name……………………..
Class 4 / …………….
Group No. ………………

If you were a farmer, what is the best way to grow a coconut?

…………………………………………………………………………………
…………………………………………………………………………………
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Appendix D

Group Assignment

Group No. …………………………

Answer the following questions:

1.   How do we make bread?
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
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2.   Is it possible to find tomatoes in Sweden in the winter?
Explain your answer.
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
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3.   What is the best way to
        a.   Preserve meats?
        b.   Preserve milk?
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
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Appendix E

Verbal Interaction Scheme*

Category	Code	Description and Examples
Informative Statement	STM	Providing information *Tomato is fruit*
Evaluative/ Argumentative		Regarding previous information from a meta-level
Argument	ARG	Logic extension reflecting reasoning
- continuation	ARG. cont	'and' *(plants can be use as a food for people) and animals*
- reason	ARG. rea	'because' *(This plant died) because there is no light*
- condition	ARG. con	'if', 'when' *(meats can be store in the freezer) if there is electricity*
- consequent/ conclusion	ARG. cone	'then', 'thus' *(Roots get the water from the soil) then the stem*
- disjunctive	ARG. dis	'or' *(seeds can be white colour) or brown*
- counter	ARG. cou	'but', 'no + explanation' *(The carrot store its food in the leaves) No in the roots*
Evaluation	EVL	Personal opinion or judgement related to the task This is really difficult / I really don't know
Elicitative		Asking for the other's (non) verbal response (questioning intonation)
Question	QST	Asking for information and checking
- disjunctive	QST. dis	Asking for a choice between two or more alternative *Is that leave or stem*
- verification own	QST. vero	Checking own ideas or reasoning *Plants need sunlight to make its food, doesn't it?*
- verification other's	QST. verot	Checking an utterance of another person *(One way of preserving the fish is by salting) Salting?*

-open	QST. open	Asking for new information (features, meaning, examples, differences or reasons, consequences) *What is the difference between fruit and vegetable?*
Request for evaluation	QST. eva	Asking for the opinion or judgement of the other Do you think this will be better?
Request	REQ	Asking the other to pass an object or to repeat the utterance Can you give me that pencil? / What did you say?
Proposal	PRO	Suggestion for a common action or a task division Lets draw a plant / when you draw, I will write
Responsive		Reacting to an utterance
Confirmation	CFM	Explicit support *yes*
Acceptance	ACC	Neutral support Okay / Good / Mm mm
Negation	NEG	Objection without explanation or an indignant repetition of what the other said No
Repeat	REP	Repeating of the previous utterance *(The plant need water) The plant need water*
Directive Order	ORD	Performing a verbal instructing act to the other Stop drawing
Off-task	OFF	Not related to the task How was your English test yesterday?

* The interaction scheme adapted from Van Boxtel (2000).

Appendix F

Coding of Episodes

Episode Type	Categories
Question	
	Answered
	- Collaborative elaborated answer
	- Individual elaborated answer
	- Short answer
	Not answered
Conflict	
	Elaborated
	- Collaborative elaboration
	- Individual elaboration
	Not elaboration
Reasoning	
	Collaborative reasoning
	Individual reasoning

* Adapted from Van Boxtel (2000).