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## Cooperative learning during math lessons in multi-ethnic elementary schools: counting on each other

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# **CHAPTER 1**

## **Learning in teams. An introduction**

### **1. Introduction**

An increasing number of elementary schools in the Netherlands have a multi-ethnic make-up, and the number of immigrant pupils is still on the rise (Gijsberts, 2004). The study by Gijsberts shows that the increasing number of immigrants is accompanied by an escalating segregation, especially in the large cities. The rising segregation in urban areas occurs in many countries, including the USA (see for a recent study, Shelton & Richeson, 2005) and Great Britain (Dixon, Durrheim & Tredoux, 2005), resulting in so-called black schools - i.e. schools where the majority of students are of foreign origin. These multi-ethnic schools, most of which are located in the densely populated western part of the country, generally have an educational disadvantage as compared to the national mean (Tesser & Iedema, 2001). These schools face social as well as educational problems: interethnic bias is daily practice. Thus, one of the major challenges these schools face is how to let students with different ethnic backgrounds get along with each other. In addition, these schools face the challenge to reduce their educational disadvantage. Several educational researchers have suggested that cooperative learning (CL) is an effective educational tool to stimulate both interethnic relations (Cohen, 1994; Warring, Johnson, Maruyama & Johnson, 1985) and learning gains (for meta analyses, see e.g., Qin, Johnson & Johnson, 1995; Rohrbeck, Ginsburg-Block, Fantuzzo & Miller, 2003). Not surprisingly, many elementary schools have taken the step to introduce CL in the classrooms (School Inspectorate, 2005; Gillies, 2004). This may be a small step for the schools, but it is a giant leap for both pupils and teachers. Research reveals that introducing CL is not particularly difficult, but implementing it successfully is (Gillies, 2003; Hoy & Tschannen-Moran, 1999; Meloth & Deering, 1999). Most teachers are not equipped to implement CL effectively (Gillies, 2003). In the case of the pupils the same applies: learning to effectively work together takes considerable time and effort (Cohen, 1994).

In this study we focused on the teacher's behavior and pupil background characteristics as important determinants of the effectiveness of CL (in terms of pupils' academic as well as social performance). In the remainder of this introduction we will outline the major theoretical views on CL and sketch what distinguishes it from other educational methods. Next, we will discuss some earlier studies in which the teacher's behavior and pupil background characteristics were investigated in the context of CL. We will now discuss our perspective on CL, our hypotheses and provide an outline of the content of this thesis.

*1.1. Deutsch: three perspectives on learning*

According to Deutsch (1949), three types of learning can be distinguished; 1), competitive, 2) individualistic, and 3) cooperative learning. Competitive learning is characterized by a negative relation in goal attainment between peers, which means that students can only reach their goals when their classroom peers fail to do so. This may result in discouraging peers' learning efforts and withholding information or even sharing false information. Competitive learning can be effective with regard to well-learned, simple tasks (Johnson & Johnson, 1994), but appears ineffective with new or complex tasks - defined as cognitively challenging tasks requiring expertise in multiple-knowledge domains- (Qin et al., 1995). Kohn (1986) argued that gaining success by making others fail is an unproductive way of learning, because, inevitably, only a few winners benefit. The losers, who make up the majority, learn to perceive learning as boring and unfair and evaluate themselves more negatively (Crockenberg, Bryant & Wilce, 1976; Kohn, 1986). The second type of learning is individualistic learning, characterized by the absence of a relation in goal attainment between peers. Students are expected to motivate themselves to perform learning tasks and to refrain from interactions with peers. Again, this type of education can be beneficial for gifted students or with simple, unchallenging tasks. However, with tasks that are new or complex, individualistic learning is less effective since pupils are unlikely to grasp the essence of all knowledge domains that make up the tasks (Cohen, 1994; Qin et al., 1995).

The third type of learning is cooperative learning, or CL, which is characterized by a positive relation between peers in goal attainment: Students need each other to successfully solve a given task. CL is the subject of this study. A large body of literature shows that CL can yield higher learning gains than individualistic and competitive learning methods (e.g., Qin et al., 1995; Rohrbeck et al., 2003) and that it impacts on a wide range of academic and social skills. In the context of this thesis, the most important skills that can be boosted by CL are math performance (e.g., De la Mata Benítez, 2003; Webb & Farivar, 1994), reading performance (e.g., Calderón, Hertz-Lazarowitz & Slavin, 1998; Morrow & Smith, 1990), social acceptance (e.g., Prater, Bruhl, and Serna, 1998; Slavin & Cooper, 1999), and peer communication (e.g., Keefer, Zeitz & Resnick, 2000; Mercer, 1996; Webb & Mastergeorge, 2003). Following Cohen (1994) we define CL in this thesis as an educational setting in which pupils work together in a group small enough for everyone to be able to participate in a clearly assigned collective task, without direct supervision from the teacher. Now that we have defined CL we will take a closer look at its theoretical underpinnings.

## *1.2. The theoretical roots of CL*

### *1.2.1. Socio-cultural theory*

Most modern research paradigms investigating the effect of social learning on academic performance build on the sociocultural approach, which originates from Vygotsky. In Vygotsky's view, learning is defined as a social process in which individual learners internalize knowledge that has been shared between learners by mediational means (Vygotsky, 1978, first published in 1930). Mediational means are semiotic tools by means of which a social action is communicated (i.e. all aspects of the context of social learning by which information can be conveyed). In his view, the process of interaction (speech) is essential for cognitive development. Vygotsky asserted that there are two types of knowledge: lower-order, or natural, knowledge and higher-order, or sociocultural, knowledge. Higher-order knowledge (e.g., memory functions), other than lower-order knowledge -which develops naturally (e.g., reflexive behavior)- is a culturally intersubjective process of internalizing (i.e. social) stimuli that was initially external, expressed in language (Moll, 1994). Intersubjectivity is defined as shared knowledge of what is being interacted or worked on (Levine, Resnick & Higgins, 1993). Development occurs as the lower-order knowledge is transformed into higher-order knowledge, which is mediated by the use of cultural tools, for instance language. As such, development can be thought of as an internalization of external, social stimuli. Intersubjectivity between young learners only occurs if the interactors have an adult supervisor to guide them or if they differ in their developmental level of cognitive capacities. However, learning will be hindered if the distance between the least and the most cognitively able interactors becomes too large, (e.g., there is no sense in explaining children how to use the internet when they do not know yet how to read and write). The distance between the most and the least capable learners should be just large enough for the least capable learner to benefit from the most capable learner. Vygotsky called this the zone of proximal development (ZPD). He also argued that cultural tools (e.g., language, culturally based customs) are essential for sharing knowledge between interactors. He emphasized that cultural diversity could enrich the process of social learning, because it offers multiple perspectives on the knowledge being shared.

When there is an adult supervisor (e.g., the teacher) to guide the pupils, the transition of the students from assisted (other-regulated) performance to independent (self-regulated) performance is facilitated. This process is called *scaffolding*. Following Webb and Farivar (1994), we view the teachers' behavior during CL as an educational tool that they use to support the pupils' development of high-quality helping behavior. In this thesis, we focus on how teachers stimulate high-quality helping behavior and refer to this type of teacher behavior as *teacher stimulation*.

### *1.2.2. Observational learning theory*

The observational learning theory by Bandura (1997) resembles Vygotsky's socio-cultural theory in some respects. Bandura argues that learning is facilitated when learners are of equal ability and/or age level, because this heightens perceptions of similarity and self-efficacy. The process by which peers explicitly compare each other's performances is called shared social appraisal. It strongly affects students' motivation to learn and the degree to which they consider themselves successful learners (Bandura, 1997). Bandura asserted that observing the successful behavior of better learners stimulates some learners to imitate their learning behavior. He argued that in a typical classroom setting students with a high-level of prior knowledge are perceived as role models for the other learners, not only by themselves but also by their peers and the teacher. However, if the gap between the learning behavior of the role model and that of the other learners becomes too big, learners with low prior knowledge will more readily attribute good marks to external sources (e.g. luck or chance), undermining their motivation to learn. This downward process is reinforced by their peers and the teacher.

### *1.3. Observational learning and ethnicity*

In observational learning, the label 'high prior knowledge' is not restrictively limited to students with high academic prior knowledge, but is also used for students with high social knowledge (i.e. popular students). Bandura asserts that students who are part from an ethnic minority are less likely to be perceived as models. Moreover, minority students are less likely to be perceived as popular than majority students (cf. Coie, Dodge & Copotelli, 1982). Allport (1954) proposed the *intergroup contact hypothesis* to reduce this behavior. This hypothesis states that forming multi-ethnic groups is not enough to combat interethnic bias. Interethnic bias can/will only be countered if four criteria are met. These are: cooperation instead of competition, equal status, common goals, and support from authorities and institutions (Allport, 1954; Van Dick et al., 2004). A meta-analysis carried out by Pettigrew and Tropp (2006) provide support for the importance of the four criteria as specified by Allport. However, Pettigrew and Tropp also demonstrated that these four criteria are not essential to a reduction in interethnic bias. Rather, their presence facilitates positive interethnic relations. Pettigrew and Tropp asserted that it is not the presence of the four conditions, but the exposure time to ethnically distinct groups that is essential for a decrease in bias. That is, the more people from different ethnic groups get to know each other, the more they are inclined to like each other. As such, the intergroup contact hypothesis is interpreted as a longitudinal model in which a fifth criterion, the opportunity to let people become friends, is the core feature (see also Pettigrew, 1998). This notion has received support from other studies (e.g., Eller & Abrams, 2004).

Based on these insights we identified important concepts in CL and set up a study to investigate how it functions in the multi-ethnic classroom. More specifically, we studied the impact of the teacher and two pupil background characteristics (ethnicity and prior knowledge) on CL effectiveness. What makes CL effective? Webb and Palincsar (1996) show in their comprehensive review study that there are different views as to what constitutes effective CL. The studies reviewed revealed that investigating the effectiveness of CL necessitates not only looking at pupils' academic performance, but also investigating their verbal behavior during team work and, not in the last instance, their socio-emotional behavior. Accordingly, in this thesis we focused not only on academic learning gains (i.e., math performance), but also on peer interactions (in terms of helping behavior) and on social skills. The latter is operationalized as pupils' popularity, their motivation to work in teams, and their perceived non-cooperativeness. Other research has corroborated the importance of these socio-emotional behaviors for the pupils' academic performance (Gillies & Ashman, 1997; Hijzen, Boekaerts & Vedder, 2006; Slavin & Cooper, 1999; Wentzel, 1993). In the next section we will discuss some of the results found by educational researchers regarding teacher stimulation and pupil background characteristics in the context of CL.

### *1.4. Research on CL*

#### *1.4.1. Teacher stimulation*

Teachers play an important part in CL; what they are doing and not doing affects the quality of their pupils' problem-solving processes considerably. Teachers who encourage pupils to use high-quality helping behavior -characterized by asking for explanations, giving explanations, and applying explanations- boost pupils' quality of peer interactions (Fuchs, Fuchs, Kazdan & Allen, 1999; Gillies & Ashman, 1997; 2000). Gillies and Ashman (1997) demonstrated that teacher stimulation of pupils' high-quality helping behavior increased their cooperativeness, helpfulness, and the provision of explanations -both solicited and unsolicited. In the same vein, stimulating pupils' high-quality helping behavior has been demonstrated to enhance peer tutoring (Nixon & Topping, 2001; Topping, 2005). In an extension of their 1997 study, Gillies and Ashman (2000) found that this also held for pupils with low prior knowledge: these pupils displayed more group involvement and were more helpful towards each other if the teacher stimulated their use of high-quality helping behavior. Moreover, high-quality helping behavior has been found to augment learning gains. For instance, Webb and her colleagues (Webb & Farivar, 1994; Webb & Mastergeorge, 2003; Webb, Troper & Fall, 1995) showed that high-quality helping behavior is related to higher learning gains (see also Topping, 2005). The studies by Webb and her colleagues have revealed that not all types of helping behavior stimulate

pupils' learning gains (see also Vedder, 1985). For instance, providing only the right answer without explanation even obstructs learning gains (Webb & Mastergeorge, 2003). Instead, the help providers have to explain *how* they arrived at a given outcome and provide the receiver with the opportunity to apply the help. Webb, Nemer, and Ing (2006) investigated whether and how pupils replicated teacher feedback during a CL program. Their study showed that if a teacher provides feedback that is characterized by low-quality helping behavior, pupils are more inclined to resort to low-quality helping behavior in their team.

Exactly how much the teacher should encourage pupils' helping behavior is still open for debate (see also Cohen, 1994; Webb et al., 2006). Various studies have revealed that adjustments in the stimulation of pupils' high-quality helping behavior should be based on background characteristics of the individual team members (Calderón et al., 1998; Cohen, 1994; Slavin & Cooper, 1999) as well as the team as a whole (Oetzel, 2001). In addition to teacher stimulation we also studied the role of ethnicity and prior knowledge.

#### *1.4.2. Student characteristics: ethnicity and prior knowledge*

Several studies have evidenced that pupils' ethnicity and prior knowledge are important characteristics that influence high-quality helping behavior and learning gains in a CL setting.

*Ethnicity.* A number of studies have shown that the teachers' stimulation of high-quality helping behavior in pupils increases their academic achievement. For instance, Calderón, Hertz-Lazarowitz, and Slavin (1998) showed that the reading performance of immigrant pupils who were stimulated by the teacher to use high-quality helping behavior (structured CL) was enhanced as compared to the performance of pupils in a control condition receiving direct instruction. Webb and Farivar (1994) found that teacher efficacy, related to the active promotion of high-quality peer interactions (provision and reception of help), was associated with students' ethnicity. Active stimulation of pupils' help giving and help receiving behavior increased immigrant pupils' high-quality helping behavior, and reduced their math disadvantage compared to Dutch pupils. As mentioned previously, immigrant pupils in the Netherlands on average have an educational barrier as compared to the national mean (Bosker & Guldemon, 2004; Tesser & Iedema, 2001). Structured CL appears to have the potential to address this problem (Slavin & Cooper, 1999; Webb & Farivar, 1994).

A number of researchers have argued that, in addition to augmenting learning gains, CL is an effective way to reduce interethnic bias (e.g., Eller & Abrams, 2004; McGlothlin & Killen, 2005). Pettigrew (1998) identifies pupils' inclination to form interethnic friendships as a reason why CL can reduce inter-ethnic bias (see also Webb & Palincsar, 1996). Pettigrew asserts that the formation of interethnic friendships is the number one reason why inter-ethnic bias decreases. In this thesis we also investigated the effect of CL on interethnic bias. However, our approach

differed from the earlier mentioned research on two grounds. Firstly, we carried out the study in a classroom CL setting instead of a direct teaching setting. Secondly, we investigated whether prolonged interethnic contact during CL stimulated interethnic friendships in addition to strengthening popularity, and decreased non-cooperative behavior in multi-ethnic teams.

*Prior knowledge.* As mentioned before, ethnicity often interacts with prior knowledge. That is, immigrant pupils often have an educational disadvantage, resulting in lower task relevant knowledge, which we refer to as poor *academic prior knowledge*. We distinguish this type of prior knowledge from a second form, namely *prior knowledge of CL skills*. With respect to academic prior knowledge, Cohen (1994) suggests that teams homogeneous as regards academic prior knowledge perform less well than heterogeneous teams. She argued that pupils with low academic prior knowledge benefit from the help provided by pupils with high academic prior knowledge. Cohen qualifies this notion by suggesting that the cognitive gap between pupils with high and low academic prior knowledge should not be too large. Other studies have revealed that students with high academic prior knowledge are more able to maintain focused on the group tasks and to plan and evaluate their actions (Hmelo, Nagarajan & Day, 2000; O'Donnell & Dansereau, 2000). Puustinen (1998) argues that teacher stimulation is important to compensate for the differences in academic prior knowledge between pupils. More precisely, she asserted that pupils with low academic prior knowledge are less able to self-regulate their learning, which heightens their need for external regulation in a structured CL context. In this thesis we defined academic prior knowledge as prior math knowledge. Regarding the effect of social prior knowledge on CL skills, research has revealed that introducing pupils to CL boosts their social skills (Gillies & Ashman, 1997; Johnson & Johnson, 1994). On the other hand, there is also evidence that the academic learning gains of students without prior knowledge of CL skills are obstructed if they are required to work in a CL setting (Hijzen, Boekaerts & Vedder, 2006). Hijzen et al. argue that this may spring from teachers' unfamiliarity with CL and uncertainty as to how to implement it effectively.

The earlier mentioned studies into prior knowledge and ethnic background support Vygotsky's assertion that cultural diversity can enrich the social learning process. At the same time they qualify Vygotsky's assertion by highlighting that learners must have prior knowledge of CL skills to be able to profit from cultural diversity.

## **2. Design of the study**

Webb and Palincsar (1996) conceive of CL as an elaborate interplay between input, process and outcome processes. They emphasized that the effectiveness of CL had best be assessed by investigating both progress in performance and conceptual development, and socio-emotional



## Learning in teams: An introduction

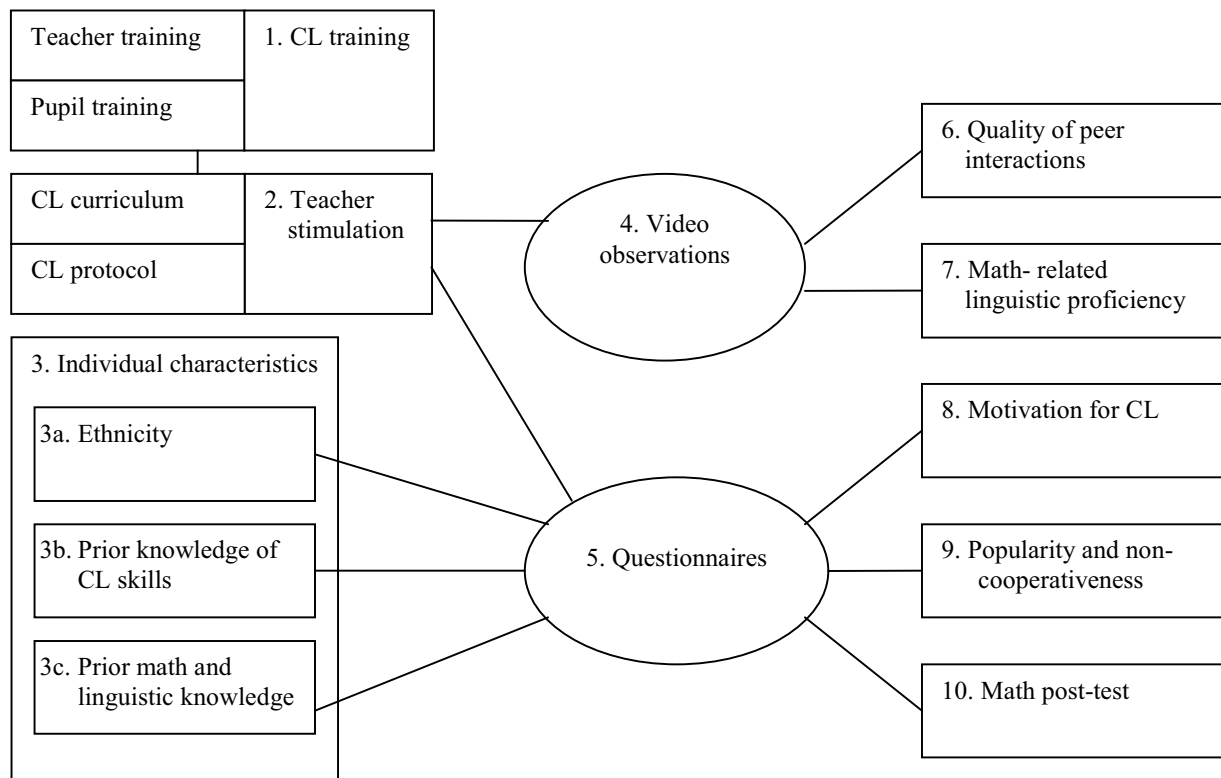


Figure 1. Design of the study

progress. The former type of assessment refers to testing student progress by using formal and informal tests that vary in depth (from automatized skills to complex concepts and reasoning) and range (from a test on a specific concept to a complete curriculum unit). The latter type of assessment refers to tools that register the quality of intergroup relations (quality of peer interactions, perceived peer support, liking classmates and feeling liked by classmates, and non-cooperativeness). In keeping with this, we focused in this thesis on pupils' academic learning gains as well as their gains in the quality of peer interactions and social skills.

### 2.1. CL training

In the CL study that we carried out to study the effectiveness of CL both the teachers and the pupils were trained how to cooperate effectively (see Figure 1, component 1).

#### 2.1.1. Teacher training

Teachers were randomly assigned to one of two conditions: the experimental or the control condition. After this, the researcher gave a mini-workshop of about two hours to each

teacher individually. Eight of the ten teachers who participated in this study did not have any prior knowledge of CL skills. Therefore, the researcher explained to the teacher what CL was about and how the CL curriculum was made up. Subsequently, the teacher was instructed how to implement CL in their classroom. Following this instruction, the teachers received a written protocol of the two CL training lessons. They were asked to carefully read this protocol and were encouraged to ask clarifying questions prior to the first CL training lesson. The CL protocol for the two CL training lessons was identical for the teachers in the experimental and the control condition.

### *2.1.2. Pupil training*

The teachers trained the children to cooperate effectively in two one-hour lessons. The researcher was present in both lessons to provide the teachers with feedback regarding their implementation of the CL rules. In lesson 1, general social CL rules were taught and practiced. These rules were: ‘everyone cooperates’, ‘everyone listens to each other’, ‘everyone shares their knowledge and opinions’, and ‘checks whether everyone agrees’. The rules were practiced in an assignment in which pupils were required to build a bridge between their tables that could bear a small weight -such as a ruler. In lesson 2, more specific CL rules were mentioned and practiced. Adapted from Webb and Farivar (1994), these rules all dealt with giving and receiving help. With respect to asking for help, we distinguished; a) ask precise questions, b) continue asking in case of ambiguities, c) think before asking a question, d) ask for help on time. With respect to giving help, we distinguished; a) fine-tuning of the level of guidance to the need for help that is requested, b) giving a clear and precise answer, c) giving the help receiver a chance to apply the help given, d) continuing to ask if the question for help is unclear, and e) giving help when needed. To ensure that pupils would more readily apply these CL rules, a series of video fragments was shown in which each rule was demonstrated both correctly and incorrectly by two actors. The pupils were asked to indicate in which fragments the CL rules were used correctly and to explain why they thought so. After the CL rules had been demonstrated and discussed, pupils practiced the rules while engaged in a CL math assignment. All CL rules (both the general and the more specific CL rules) were written down on a poster, which was displayed in the classroom and was clearly visible to all children in all classes, indifferent of the condition. This poster remained there throughout the whole CL curriculum as a memory aid for the pupils. In addition to the poster, all pupils were required to fill in a short checklist halfway each lesson. It served as a check for pupils to see for themselves which CL rules they used (in)adequately. These checklists asked for the level of application of the general social CL rules that were taught in lesson 1 of the CL training and the amount of help given and help received (lesson 2 of the CL

training). These checklists were not used for analysis; they solely served as a memory booster for the pupils.

## *2.2. Teacher stimulation*

The difference between the experimental condition and the control condition was that the teachers in the experimental condition were instructed to stimulate pupils' high-quality helping behavior (Figure 1, component 2). In the control condition teachers were instructed not to intervene with pupils' use of high-quality helping behavior. That is, pupils were not encouraged to use high-quality helping behavior, but when pupils did make use of high-quality helping behavior they were not discouraged in doing so either. Teachers in the control condition did not object to the fact that they were required to let pupils fend for themselves, because they were not experienced in stimulating the pupils' high-quality helping behavior in any case and they did not have firm beliefs as to whether stimulating pupils to help other pupils was beneficial for learning. After the CL training, but preceding the implementation of the CL curriculum, the teachers received a protocol with detailed instructions regarding the nine CL math lessons. The researcher observed the first four lessons of the teachers in both conditions and provided feedback as to whether the teachers behaved in accordance with the conditional requirements.

The CL curriculum that the teachers carried out consisted of nine one-hour math lessons, covering five weeks. Each lesson was made up of two CL math assignments, totaling 18 assignments. The assignments dealt with surface, percentage, scale, estimation, and fractions. All assignments were adapted for CL purposes from the *Pluspunt* math curriculum (Bergervoet, Roijackers & Rouvroye, 2001) that employs realistic math problems with a narrative composition. Realistic math problems are characterized by an emphasis on situating math problems in contexts which are familiar to the children, like the zoo and the school yard. The assignments that were used in the CL curriculum were moderately structured, open-ended, narrative math assignments, all of which consisted of three parts. Firstly, team members had to individually work on a part of the math task. Secondly, they had to discuss their findings. Thirdly, all team members were required to cooperate to solve the last part of the math task. Each teacher was instructed to convey to the pupils that their job was to understand the CL math assignments, rather than completing them.

## *2.3. Individual background characteristics*

'Ethnicity' and 'prior math knowledge' were assessed prior to the CL curriculum (Figure 1, component 3). Prior math knowledge and linguistic proficiency were assessed with curriculum

independent tests from the national testing service (CITO; Janssen, Kraemer, & Noteboom, 1996). On the basis of pupils' prior math knowledge they were placed in teams that were narrow-heterogeneous in prior math ability (high-middle, or low-middle). The ethnic composition of the teams was not manipulated. 'Prior knowledge of CL skills' was assessed by a teacher questionnaire, on which teachers were required to indicate how much experience they themselves and their pupils had with CL.

#### *2.4. Video observations*

We made video recordings of both the peer interactions and the teacher-student interactions (Figure 1, component 4). The teacher-student interactions were recorded to assess the treatment integrity. The recordings of the teachers in the control and the experimental condition were used to assess their stimulation of helping behavior preceding, during, and after the group work for two CL lessons. The peer interactions were videotaped twice to investigate pupils' use of helping behavior (Figure 1, component 6) and their math-related linguistic proficiency (Figure 1, component 7).

#### *2.5. Questionnaires*

A number of pupil questionnaires was used to assess background characteristics, math performance, and social learning gains (Figure 1, component 5). All questionnaires were filled in individually. Regarding pupils' social learning gains, they filled in a questionnaire about their motivation for CL (Figure 1, component 8), a questionnaire that assessed their perception of the non-cooperativeness of the other team members, and a questionnaire that required them to rate the popularity of their team members as perceived by the whole class (Figure 1, component 9). These questionnaires were filled in both at the onset and the end of the CL curriculum. The 'math post-test' is a curriculum dependent math test that was filled in by the pupils at the end of the CL curriculum (Figure 1, component 10). It was incorporated to measure pupils' math knowledge of the 19 CL math assignments.

In addition to the pupil questionnaires, we administered a questionnaire to the teachers regarding how much they perceived themselves to stimulate pupils' high-quality helping behavior (related to Component 2, Figure 1). Teachers were required to complete these questionnaires at the end of every week.

### 3. Sample

A letter with a request to participate in this CL study was sent to 200 schools. The schools were telephoned after approximately a week to inquire whether the teacher(s) from the 5th grade wanted to participate in this study. Only those teachers who met the following three criteria were enrolled in the study: 1) willing to spend time outside the regular curriculum on the preparation of the math lessons, 2) at least 25% of the pupils in their class was immigrant, and 3) they had to employ an authentic math curriculum (Pluspunt).

Ten teachers from ten schools met the earlier mentioned criteria. Each teacher and his/her classroom were then randomly assigned to the experimental and the control conditions. In eight of the ten classes both pupils and teachers had no prior knowledge of CL skills. In the other two classes the teachers had implemented it regularly (one in the control condition and one in the experimental condition). The total sample consisted of 48 teams ( $N = 166$ ).

### 4. Analytical perspective

In the past, traditional cognitive psychology viewed mental processes as individual, domain-independent skills (cf. Mayer, 1987). This perspective resonated in early CL studies, where only the effect of CL on the performance of *individual* learners was investigated (e.g., Okebukola, 1986; Peterson & Swing, 1985; Slavin, 1980; Warring, Johnson, Muruyama & Johnson, 1985). Nowadays, most scholars agree that ‘experts’ utilize general skills as a stepping stone for swifter acquisition of domain-specific, or situational skills (Hatano & Wertsch, 2001). Their emphasis on the importance of situational factors has brought about that CL effectiveness is increasingly being investigated with a multilevel approach. For instance, Rogoff (1995) argued that to assess the full impact of CL on a learner, one has to look at the individual (individual plane), the group of which the individual is part (interpersonal plane), and the social learning setting wherein the group is located (community plane). Theorists like Rogoff (see also Kumpulainen & Mutanen, 1999; Levine et al., 1993; Wertsch, Del Río & Alvarez, 1995) are part of a research tradition called situated cognition. They argue that rather than mediating cognition, social factors *constitute* cognition. That is, the individual is not assumed to be able to take a cognitive skill acquired in one context and apply it in another context, unless the new context facilitates this transfer (see for a more detailed discussion Anderson, Reder & Simon, 1996). In this thesis we acknowledge the interdependence between learners working in teams. Although our samples were too small to adopt a multilevel approach, we have attempted to take the within-group dependency into consideration by analyzing the data at both the individual and the team level.

## 5. Overview of the thesis and hypotheses

In this thesis we attempted to shed light on teacher stimulation and two pupil background characteristics (i.e. ethnicity and prior knowledge) on the math performance, quality of peer interactions, popularity, motivation for CL, and perceived non-cooperativeness of elementary school pupils aged 10 to 12 year old in a CL math setting. Figure 2 depicts the relations that were investigated. We will present our hypotheses in the order of the output variables.

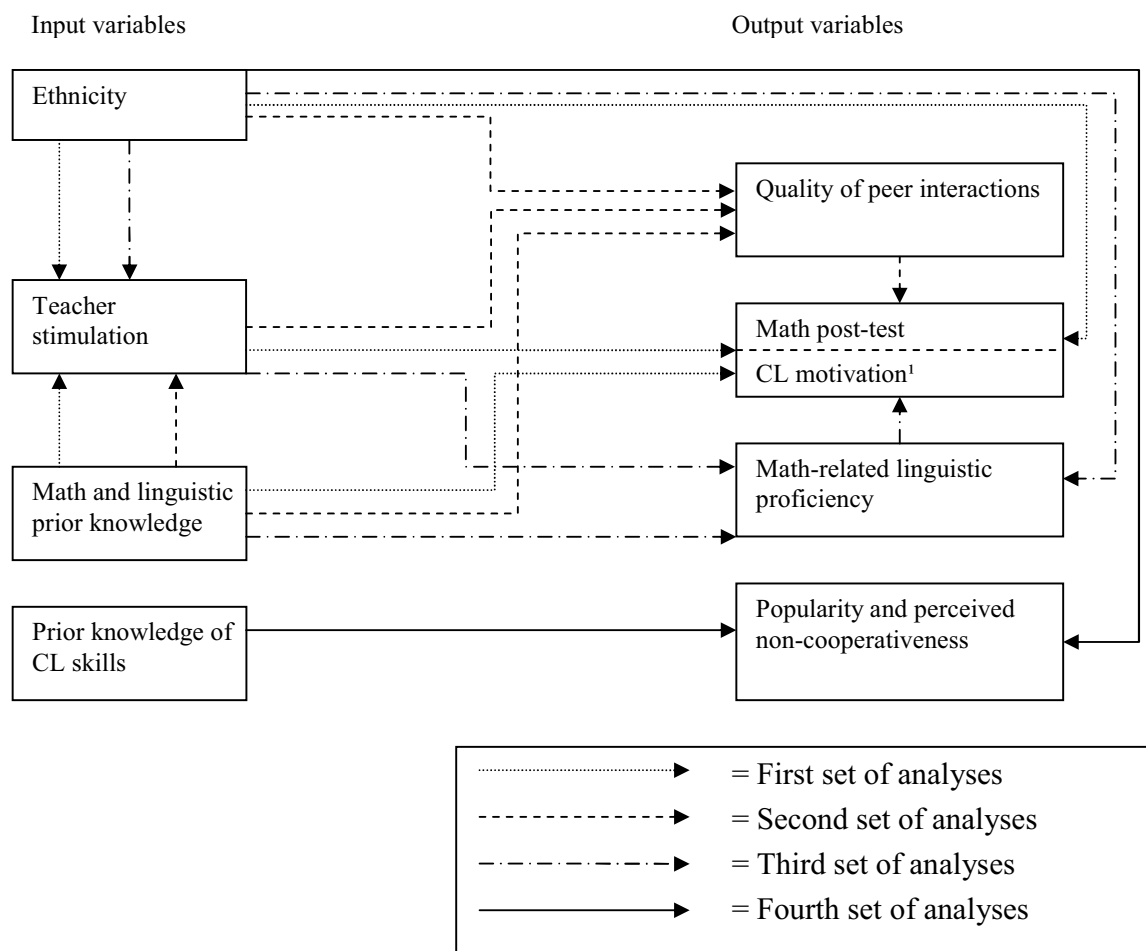


Figure 2. The relations that are investigated in this thesis

<sup>1</sup> This output variable was only measured in study 1.

The empirical body of this thesis covers the four sets of analyses that are visualized in Figure 1. These sets of analyses draw on the same sample ( $N = 166$ ), but each set highlights a different process or output variable. The sample sizes differ for each set of analyses, due to the

time-consuming nature of the measurement of some variables -such as the videotaped peer interactions- and missing data. The first set of relations we have investigated -depicted by a dotted line in Figure 2- regards the impact of teacher stimulation on pupils' math post-test scores and motivation for CL and how these relations are affected by the pupils' ethnicity and prior math knowledge. In accordance with the studies mentioned previously (e.g., Gillies & Ashman, 1997) we hypothesized that teacher stimulation of the pupils' use of high-quality helping behavior (the experimental condition) boosts their math post-test scores as compared to the control condition, where the teacher does not encourage pupils to use high-quality helping behavior. Furthermore, we investigated how the stimulation of pupils' high-quality helping behavior interacts with the pupil background characteristics ethnicity and prior math knowledge. Whereas Webb and Farivar (1994) focused on ethnicity, and Gillies and Ashman (2000) focused on prior math knowledge, we examined both. We hypothesized that the math post-test scores of the immigrant pupils and pupils with low prior math knowledge are higher if their high-quality helping behavior is stimulated. In addition, we hypothesized that teacher stimulation of the pupils' use of high-quality helping behavior boosts the pupils' motivation to cooperate as compared to the control condition, where the teacher does not stimulate pupils' use of high-quality helping behavior. Extending the findings of Gillies and Ashman (2000), we hypothesized that the motivation to cooperate is higher for the immigrant pupils and pupils with low prior math knowledge in the experimental condition than for immigrant pupils and pupils with prior math knowledge in the control condition. Lastly, we explored whether including linguistic ability in the statistical analyses model results in a better prediction of math post-test scores.

The second and third set of hypotheses that were examined in this thesis concentrated on the pupils' verbal behavior during CL. The second set -depicted by a broken line in Figure 2- targeted the quality of the verbal helping behavior of the pupils (Chapter 3) and the third set -depicted by a broken / dotted line in Figure 2- focused on pupils' math-related linguistic proficiency (Chapter 4). Regarding the quality of verbal helping behavior, we videotaped the pupils' helping behavior and analyzed this with the use of a coding scheme adapted from Webb and Mastergeorge (2003). We aimed to generalize the findings of Webb and Mastergeorge (2003) by demonstrating that not only high-quality helping behavior is positively related to math post-test scores, but tutoring behavior as well. Additionally, we hypothesized that the quality of helping behavior is higher in the experimental condition than in the control condition. In keeping with Gillies and Ashman (2000) we hypothesized that teacher stimulation increases the use of high-quality helping behavior by pupils with low prior math knowledge. In line with the findings by Webb and Farivar (1994) we hypothesized that teacher stimulation augments immigrant pupils' high-quality helping behavior more than that of national pupils. Finally, we investigated the interaction of ethnicity with prior math knowledge: national pupils with low prior math

knowledge were hypothesized to display more high-quality helping behavior in the experimental condition as compared to immigrant pupils with low prior math knowledge.

With respect to pupils' math-related linguistic proficiency we also videotaped the peer interactions and analyzed this with a coding scheme based on studies by Vedder, Kook and Muysken (1996), Levorato and Cacciari (1995), and Niemi (1996). We hypothesized that pupils' math-related linguistic proficiency is positively related to their math post-test scores. In keeping with Calderón et al. (1998), we hypothesized that teachers who stimulate the pupils' use of high-quality helping behavior boost their math-related linguistic proficiency as compared pupils who do are not stimulated by the teachers in their use of high-quality helping behavior. With regard to the experimental condition, we proposed that the math-related linguistic proficiency of immigrant pupils increases more than that of national pupils.

Finally, we investigated the effect of prior knowledge of CL skills on pupils' popularity and perceived non-cooperativeness (Chapter 5). We proposed that team members' perception of intragroup popularity increases and their perceived non-cooperativeness decreases in function of the time they spend working in their team. In keeping with Slavin and Cooper (1999) we hypothesized that both the popularity of immigrant pupils increases and their perceived non-cooperativeness decreases with more CL experience. Lastly, we aimed to extend the finding that the positive effect of CL time on reducing interethnic bias also holds for popularity and perceived non-cooperativeness: we expected that the popularity within ethnically heterogeneous teams is augmented and their perceived non-cooperativeness reduced with increasing CL experience.

These four empirical chapters are followed by a concluding chapter discussing the extent to which the findings reported in the four studies confirmed our hypotheses, what the implications are for future studies, and how our findings translate to the educational setting.



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