

Developments in Cooperative Learning: Review of Research

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Título: Avances en el aprendizaje cooperativo: Revisión de la investigación

Resumen: El aprendizaje cooperativo, donde los estudiantes trabajan en pequeños grupos para lograr metas compartidas, es ampliamente reconocido como una estrategia de enseñanza que promueve el aprendizaje y la socialización entre los estudiantes desde Educación Infantil hasta la Universidad y en las distintas materias curriculares. Se ha utilizado con éxito para favorecer el logro en la lectura y escritura, en la comprensión y el desarrollo conceptual en las clases de ciencias, en la resolución de problemas en matemáticas, en el pensamiento de orden superior y en el aprendizaje, por nombrar sólo algunos. Se ha comprobado que mejora la disposición de los estudiantes para trabajar de forma cooperativa y productiva con alumnos con distintas necesidades de aprendizaje y de ajuste y mejora las relaciones intergrupales entre grupos cultural y étnicamente diversos. También se ha utilizado como estrategia de enseñanza para ayudar a los estudiantes a manejar los conflictos y ayudar a los estudiantes identificados como agresores, a que aprendan habilidades interpersonales adecuadas. En efecto, se afirma que las experiencias de aprendizaje cooperativo son cruciales para prevenir y paliar muchos de los problemas sociales relacionados con los niños, adolescentes y adultos jóvenes. No hay duda de que los beneficios atribuidos al aprendizaje cooperativo son extensos y numerosos, y es el aparente éxito de este enfoque del aprendizaje lo que le ha llevado a ser reconocido como una de las mayores innovaciones educativas de los últimos tiempos.

El objetivo de este trabajo es, no sólo revisar la evolución de la investigación sobre aprendizaje cooperativo, sino también, examinar los factores que median y moderan su éxito. Concretamente, la revisión se centra en los tipos de interacciones que se generan entre alumno y profesor y en el papel clave que desempeña el habla en el desarrollo del pensamiento y el aprendizaje del alumno, a través de la expresión de opiniones contrapuestas o la construcción de significados compartidos. La intención es proporcionar conocimientos adicionales sobre cómo los profesores pueden utilizar de manera eficaz este enfoque pedagógico para la enseñanza y el aprendizaje en sus aulas.

Palabras clave: Cooperative learning; social collaboration; dialogic teaching; group interactions; pedagogical practice

Abstract: Cooperative learning, where students work in small groups to accomplish shared goals, is widely recognized as a teaching strategy that promotes learning and socialization among students from kindergarten through college and across different subject domains. It has been used successfully to promote reading and writing achievements, understanding and conceptual development in science classes, problem-solving in mathematics, and higher-order thinking and learning to name just a few. It has been shown to enhance students' willingness to work cooperatively and productively with others with diverse learning and adjustment needs and to enhance intergroup relations with those from culturally and ethnically different backgrounds. It has also been used as a teaching strategy to assist students to manage conflict and to help students identified as bullies learn appropriate interpersonal skills. In fact, it has been argued that cooperative learning experiences are crucial to preventing and alleviating many of the social problems related to children, adolescents, and young adults. There is no doubt that the benefits attributed to cooperative learning are widespread and numerous and it is the apparent success of this approach to learning that has led to it being acclaimed as one of the greatest educational innovations of recent times.

The purpose of this paper is not only to review developments in research on cooperative learning but also to examine the factors that mediate and moderate its success. In particular, the review focuses on the types of student and teacher interactions generated and the key role talk plays in developing student thinking and learning, albeit through the expression of contrasting opinions or constructed shared meaning. The intention is to provide additional insights on how teachers can effectively utilize this pedagogical approach to teaching and learning in their classrooms.

Key words: Cooperative learning; social collaboration; dialogic teaching; group interactions; pedagogical practice

Introduction

Cooperative learning is widely recognized as a pedagogical practice that promotes learning and socialization among students from kindergarten through college and across different subject domains (Johnson & Johnson, 2002; Serrano & Pons, 2007; Sharan, Y., 2010; Slavin, 1996). It has been used successfully to promote reading and writing achievements (Stevens & Slavin, 1995a), including for students who are academically delayed (Stevens & Slavin, 1995b), conceptual development in science classes (Howe, 2013a), problem-solving in mathematics (Pons, Gonzalez-Herrero, & Serrano, 2008; Slavin, 2013; Slavin & Lake, 2008), and higher-order thinking and learning (Gillies, 2011) to name just a few. It has been shown to enhance students' willingness to work cooperatively and productively with others with diverse learning and adjustment needs, to enhance intergroup rela-

tions with those from culturally and ethnically different backgrounds (Johnson & Johnson, 2000; Slavin & Cooper, 1999), and to promote social connectedness in transitioning from primary school to high school (Thurston et al., 2010). It has also been used as a teaching strategy to assist students to manage conflict (Cowie, 1995; Pulido et al., 2013), to help students identified as bullies learn appropriate interpersonal skills (Cowie, 2004) and to train teachers from pre-school to high school in how to embed cooperative learning into their classroom pedagogy (Pons, Sharan, Serrano, Lomeli, & Buchs, 2013). In fact, it has been argued that cooperative learning experiences are crucial to preventing and alleviating many of the academic and social problems related to children, adolescents, and young adults (Johnson & Johnson, 2003). There is no doubt that the benefits attributed to cooperative learning are widespread and numerous and it is the apparent success of this approach to learning that has led to it being acclaimed as one of the greatest educational innovations of recent times.

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Background research on cooperative learning

One of the first theorists to recognize the inter-relatedness of the person and the social environment was Kurt Lewin (1947) who recognized “that groups have properties of their own, which are different from the properties of their subgroups or their individual members” (p. 8) and, as such, it is important to investigate the relationships between members of a group if the behaviour of the group is to be understood. Concurrently with Lewin’s research on group behaviours, different socio-metric techniques such as sociograms, observations, surveys, and interviews were being developed which enabled the structural properties of groups, the relationship between groups and subgroups and between groups and their individual members to be collected, analysed, and graphically represented. Interestingly, Lewin found that these relationships were dynamic and changed depending on the membership of the group and the issues it was confronting. Moreover, he saw the potential these socio-metric techniques had for solving research questions of significant social value such as how group behaviours and actions affect group life and cultural values and how, individuals, in turn, are affected by group membership.

Building on Lewin’s work on the dynamic and changeable nature of group relationships, Morton Deutsch (1949a) investigated interactions between individuals and group processes that emerged as a consequence of cooperation or competition in social situations. In a now famous study conducted with first year college students, Deutsch (1949b) set about to determine how individuals perceive they are either cooperatively or competitively linked. His basic hypothesis was that if individuals are working together to attain a group goal, they will perceive themselves as being more psychologically interdependent than individuals who are in a competitive social situation. When this happens, group members will actively try and coordinate their actions so that opportunities are provided for others to contribute, provide assistance when it is needed, and encourage others efforts. As a consequence of the cooperative group experience, Deutsch also hypothesized that group members would be more willing to share ideas and information with each other, be more cohesive as a group, and more motivated to achieve the group’s goals than others in a competitive situation. Furthermore, groups would be more productive and more willing to strive towards better quality outcomes than those who work competitively.

The 50 participants in Deutsch’s study (Deutsch, 1949b) were formed into 10 tentative groups on the basis of their availability to meet. At the first meeting, the groups were presented with a social problem which they were asked to discuss before writing recommendations to solve the dilemma. During this first meeting, groups were then ranked and paired with each other on the productivity of their discussions. Each pair was then assigned to a cooperative or competitive weekly group experience for the next five weeks during which time they discussed problems designed to test

their ability to engage in clear, logical thinking and social problem-solving. Each group was observed and rated on the basis of their productive group discussions, group orientation, self-centeredness, involvement, attentiveness, communicative difficulties, and acceptance or rejection of other’s ideas. In addition, participants completed a weekly questionnaire that paralleled those items on the observers’ rating scales as well as items that were designed to elicit their perceptions of their interest in working in their groups, their feelings towards their group, the extent of group cooperation and productivity which they experienced, and the reactions of others to their own contributions and so on.

The results showed that students in the cooperative groups were rated by their observers as having a stronger sense of “group” or group feeling than their peers in the competitive groups. The cooperative groups worked together more frequently and were more highly coordinated or synchronized so that they avoided duplicating each other’s efforts, enabling group members to work on different components of the task simultaneously. They were also more attentive to what others had to say, were more motivated to achieve, and were more productive in what they achieved than their peers in the competitive groups. Furthermore, these observations were confirmed by the students’ responses to the follow-up weekly questionnaires. The consequences of this study were to challenge traditionally held beliefs that students who compete to receive rewards work better than students who cooperate.

Empirical research on cooperative learning

Interest in cooperative learning began to emerge in the 1970s as reports on the social and academic benefits students obtained from working together to assist each other to learn began to be published (Brown et al., 1971; Cloward, 1967; Gartner et al., 1971). These studies showed that children could be taught to facilitate academic accomplishments in others, help underachieving children overcome their motivational deficits, improve attitudes towards others, and enhance each other’s communication skills. However, Damon (1984) argued that for these benefits to be realized, tutors needed to be trained in interpersonal skills as well as the subject matter to be taught, peer tutors needed to be supervised, groups should not exceed four members, and children should be encouraged to express their opinions and offer solutions to problems they were discussing. Allen (1976) observed that when this occurred not only did tutees benefit from the tutoring they received but tutors also benefited, mainly because they had to cognitively restructure the information they were teaching in order to explain it in a way that the tutee could understand. In so doing, they often further consolidated their own understandings of the information they were teaching and gained greater mastery over it than they had previously. These findings were exciting and helped to stimulate further research on cooperating groups

and how they could be used to facilitate learning and socialization.

As many schools demonstrated traditional instructional modes of learning where students were expected to be passive recipients of knowledge imparted by the teacher, the focus of the research was on comparing cooperative learning to competitive and/or individual modes of learning. In 1981, Johnson and colleagues (Johnson, Maruyama, Johnson, Nelson, & Skon) published the results of a meta-analysis that they conducted on 122 studies that examined the effects of cooperative, competitive, and individualistic learning on achievement. The results showed that cooperation promotes higher achievement and greater productivity than do competitive or individualistic modes of learning and these results were consistent across all subject areas, all age groups, and for a variety of cognitively challenging tasks. Interestingly, as cooperation increases, students produce a better group product when they compete as a group against other groups.

In a follow-up meta-analysis of 111 studies Johnson and Johnson (2002) examined the effects of cooperative, competitive, and individual learning on a number of academic, personal, and social dependent variables (e.g., achievement, interpersonal attraction, social support, self-esteem, perspective taking, and controversy) and found that the mean effect sizes (i.e., the strength for the relationship between the independent and dependent variables) for cooperative learning ranged from 0.58 to 0.70 in comparison to competitive and individualistic learning. These are effect sizes that Hattie (2009) believes are noticeable and can make “real-world differences” (p.17) in educational interventions. In short, the results of this meta-analysis and the Johnson et al. (1981) meta-analysis, cited previously, indicate that cooperative learning in comparison to competitive and individualistic learning has very powerful effects on achievement, socialization, motivation, and personal self-development.

In a best evidence synthesis of 60 studies of the effects of cooperative learning in comparison to control methods on students achievement in elementary and high school classes, Slavin (1996) found that while cooperative learning clearly had positive effects on students’ achievement, opportunities for learning can be maximized if group goals and individual accountability are embedded in the cooperative method used. The key difference between the studies that included these criteria and others is the importance attached to group members working together as a team to attain group rewards. Slavin argued that traditional unstructured group work where students are expected to work together but are given few incentives to do so has been repeatedly shown to have little or no effect on learning. Similar results have been reported by Gillies (2003, 2004, 2006) who has repeatedly found that students achievement is enhanced and they are more willing to cooperate when they work in structured small groups where they understand that they are interdependently linked together and that everyone must contribute if the group is to complete its goal. This is in contrast to unstructured groups where students often work in groups

where members are not interdependently linked and there is little or no expectation to contribute.

There is no doubt that cooperative learning as an instructional strategy has had a profound effect on how learning environments in schools are structured to promote student learning and socialization. In a meta-analysis of 148 independent studies comparing the relative effectiveness of cooperative, competitive, and individualistic goal structures, Roseth, Johnson and Johnson (2008) found that higher achievement and more positive peer relationships were associated with cooperative rather than competitive or individualistic goal structures. In a similar vein, in a best-evidence analysis of a series of systematic reviews of research on primary and secondary mathematics, reading, and programs for struggling readers, Slavin (2013) reported that programs that provide extensive professional development in well-structured methods such as cooperative learning and the teaching of metacognitive skills produce more positive effect sizes than those evaluating other curricula reforms or computer-assisted instruction.

Appeal of cooperative learning

There is no disputing the fact that cooperative learning has popular appeal, not only because of the academic benefits that students derive but also because of the documented improvements it promotes in interpersonal and inter-group relationships (Sharan, 1990). Having students interact and work together not only enables students to learn from each other but it often leads to a decline in disruptive behaviour as students are more actively involved in their own learning. In fact, Sharan and Shaulov (1990) argued that students often become highly motivated to learn when they have opportunities to work together in small cooperating groups where they are given more autonomy over the tasks they are to complete and the decisions they need to make about the processes to be employed and the products they are to produce. It is this opportunity to be more active in their own learning that engages students’ interest and has a positive effect on the learning that occurs.

Encouraging teachers to be less “the sage on the stage” and more “the guide on the side” also appears to be critically important to the success of cooperative learning. Hertz-Lazarowitz and Shachar (1990) found that when teachers reduce their centrality in the classroom, student to student interactions are more pro-social with students becoming more cooperative and demonstrating more attention to the task at hand. Interestingly, Hertz-Lazarowitz and Shachar also found that when teachers change their instructional style to cooperative learning they become more involved in a complex process of linguistic change as well as their language becomes more caring and personal as they work more closely with small groups. In so doing their language is often more spontaneous, varied, and creative and they communicate more positive affective messages to their students. This is in contrast to traditional classrooms where teachers’ language is

often regarded as authoritarian, rigid, and less friendly, and teachers are often perceived as distant or impersonal (Bosworth, 1995). In these classrooms, teachers often direct the learning while students are expected to be passive and respond only when required to do so.

Interaction among group members is critically important to the success of small group activities and Shachar and Sharan (1994) argued that this will only happen when teachers create conditions that enable students work in small groups on tasks that require cooperation among group members. The importance of arriving at a synthesis of everyone's contributions and the expectation that the group product will be presented to the wider class are structures that are designed to foster group cohesion and motivate students to complete the task. When teachers structure small group activities so that these conditions are met, students are more interactive, using more words per turn of speech, communicate more equitably so ideas are shared among group members, and elaborate more to explain the problem at hand.

Role of talk in mediating learning during social collaboration

Interest in the key role talk plays in the construction of knowledge, understanding and learning has gathered momentum in recent years as various studies have been published that demonstrate the importance of social collaboration in promoting intellectual development and educational attainment (Mercer, 1996, 2008; Resnick, 1991; Wells, 2007). While proponents of both individual constructivism (Piaget, 1950) and social constructivism (Vygotsky, 1978) emphasize the importance of social interaction in the development of children's language and cognitions, it is only in the last 30 years that research has emerged that demonstrates how children benefit from interacting with their peers and how teachers, in turn, can construct experiences in classrooms to ensure the benefits attributed to such experiences are realized.

Building on the Piagetian idea that children learn when they are confronted with information that challenges their thinking, Adey and Shayer (1990, 1993, 1994) reported on a series of cognitive acceleration (CA) programs in science and mathematics in primary and secondary schools where children were confronted with cognitively challenging tasks but in a social situation where the teacher mediated the process of reflective abstraction and conflict resolution "in a context of Vygotskian-like scaffolding" (Adey, Csapó, Demetriou, Hautamäki, & Shayer, 2007, p. 89). The effects of these programs on students' cognitive development and academic achievements were significant when compared to controls who did not participate in these programs. Furthermore, the gains recorded generalized to national public examinations taken three years later in science and mathematics as well as English even though this latter subject was not targeted in the original cognitive acceleration

programs. Adey et al. proposed that the transfer of the CA effects to English seems to offer support for the notion of a "general intellectual processor which can be enhanced in one context but then becomes available to be deployed in a quite different context" (p.89).

Adey and Shayer (2011) attributed the success of their CA programs to three core principles which were embedded in each program: Cognitive conflict, social construction, and metacognition. The first core principle, cognitive conflict, occurs when children are presented with situations that are challenging, which cause them to stop and think, and to reflect on how they must proceed to solve the problem they are confronting. In order to reconcile any anomalous situation, students need to be active participants in the construction of knowledge rather than passive recipients and, in so doing, engage in a process of constructing meaning where they reflect on experiences and revise them in the context of new understandings and cognitions (Piaget, 1950). Teachers promote cognitive growth in children when they use language that challenges their understandings, confronts discrepancies in their thinking, and requires them to provide reasons for their solutions (Gillies, 2011).

The second principle, social construction, emphasizes the importance of students co-constructing knowledge by interacting with each other. Adey and Shayer (2011) believed that intelligence is socially constructed and happens when individuals have opportunities to work with others in a group, discuss, argue, and constructively build on others' ideas in order to re-construct understandings and potentially contribute new ideas. In effect, knowledge is socially constructed and in order for this to happen, teachers need to embrace a new pedagogy where collaboration is encouraged and problems that students discuss are open and discovery-based. Cohen (1994) found that when a task is open and discovery-based so there is no one correct answer, group members show high levels of cooperation as they must discuss how they will proceed as a group and share ideas and information. With this type of task, productivity depends on social interaction. In fact, Cohen argued that it is the frequency of task-related interactions that is related to gains in follow-up content-referenced tests and conceptual development in mathematics and computational tasks.

The third principle, metacognition (Adey & Shayer, 2011), occurs when students are encouraged to reflect on their own learning; what they have learned and what they may still need to learn. Dweck (2011) believes that teachers can encourage this type of reflection when they ask children to identify where they learnt specific information or by giving them an enactive view of their own abilities. Certainly, a large body of research indicates that children can be taught to engage in metacognitive processes and that they, in turn, can teach these skills to their peers. Shamir, Zion, and Spector-Levi (2008) reported on how a peer mediation program for children in grades 1 and 3 was used to enhance both the tutors and tutees critical thinking skills and the quality of their discourse. Similar results were obtained by Gillies and

Khan (2008, 2009) who found that teachers can be taught to use specific questioning strategies that challenge and scaffold children's thinking and that this, in turn, leads to the development of higher quality discourse and better reasoning and problem-solving skills in their students. Reznitskaya (2012) noted that students' thinking is enhanced when teachers engage students in dialogic exchanges where the discourse is shared, questions are open or discovery-based, teachers provide meaningful feedback, students scrutinize both the product and processes of their discussions, students elaborate on their thinking, and, in so doing, engage in the collaborative co-construction of knowledge. In short, Adey and Shayer, Dweck, Shamir et al., Gillies and Khan, and Reznitskaya have demonstrated that children can be taught to think meta-cognitively and that this has a positive effect on their interactions, thinking, and learning.

Other researchers who have investigated the powerful effects of dialogic interactions on students' thinking and learning include Resnick, Michaels and O'Connor (2010) and Michaels and O'Connor (2011) with their research on Accountable Talk. Accountable Talk is a way of teaching children how to interrogate topics under discussion using well-reasoned and logical arguments that involves explanation and self-correction rather than just supporting or attacking conclusions. Accountable Talk draws on socio-cultural principles that emphasize the importance of social practices, and, in particular, the importance of social interaction in the development of individual mental processes.

Accountable Talk

In the Accountable Talk classroom, the teacher may initiate the discussion by asking thought-provoking questions that challenge students to offer elaborated responses or explanations that can be accepted or challenged by others in the class. During the interaction that occurs children are encouraged to challenge other's claims, justify and explain their own positions, and rebut and reconcile anomalous stances and so on. The process includes extended exchanges between teacher and students and students and students with the teacher engaging in a number of "talk moves" (Resnick et al., 2010, p. 7) designed to help students to understand how to build on the ideas of others, ask questions to clarify or expand propositions, and extend or elaborate on one's own position or argument.

"Re-voicing" or paraphrasing a students' contribution to ensure that the true meaning of the interaction is understood by all the students in the class is an example of how a teacher can employ such a move. Other talk moves include asking students to re-state someone else's reasoning, consider alternative perspectives on a problem, articulate their own reasoning, and challenge or rebut a particular position. In effect, the process includes extended exchanges designed to encourage the students to think deliberately about problems under discussion. The teacher is often highly interactive when employing this type of discourse, often switching be-

tween providing authoritative knowledge to ensure that students acquire discipline correct concepts to being more dialogic where students are challenged and scaffolded to explore new ideas, ask questions, interpret findings, formulate hypotheses, and share their understandings.

In so doing, Resnick et al. (2010) argue that evidence is beginning to emerge that this type of discourse-intensive instruction does support children's learning. O'Connor, Michaels and Chaplin (in press) elaborate further by discussing two studies that provided support for the importance of Accountable Talk in promoting students' classroom discussions and learning. In the first, Project Challenge (an intervention designed to provide talented students in low socio-economic schools with a challenging mathematics curriculum), the authors discuss how they taught teachers to use different talk moves or "families of utterances that help teachers in the moment-to-moment micro-interactional challenges of orchestrating student discussion" (p.2) to help students to contribute their own ideas, listen to others, focus on reasoning, and work respectively and productively together. When these conditions were created, student discussions were more frequent, elaborate, and sustained and, as a consequence, students who participated in Project Challenge obtained significantly higher standardized test results than their same age regular education matched peers. Given that these results were consistent across four cohorts of students for the four years of the intervention, the effect of Accountable Talk on students' results were dramatic. Interestingly, although Project Challenge was limited to mathematics instruction, students standardized English Language Arts scores were also significantly higher than same-age matched peers who had not participated in Project Challenge. These results led O'Connor et al. to propose that improvements in student learning in both mathematics and English language arts are plausibly related to the intense use of academically productive classroom talk.

In the second study, O'Connor et al. (in press) investigated how classroom talk (i.e., Accountable Talk) supported measurable learning gains through an in-depth, in-vivo efficacy study of classroom talk. Using the same teacher to teach two different classes in order to overcome teacher effects, O'Connor et al. used a cross-over design to determine the effects of academically productive talk versus direct instruction on students' learning outcome scores. The results showed that students obtained significantly higher learning outcome scores when they experienced academically productive talk than when they experienced direct instruction.

The results obtained from the two studies described above led O'Connor et al. (in press) to conclude that "Through daily use of classroom talk to introduce, rehearse, and practice mathematical ideas and procedures, we might suppose that cognitive, linguistic, and metacognitive skills would improve" (p. 13). Certainly, the effects of Accountable Talk on students' thinking and academic achievements led to significant improvements not only on their standardized test scores in mathematics but also in English, thereby

demonstrating that socio-linguistic-cognitive skills learnt in one subject area do transfer to another. Moreover, these improvements were maintained three years after the students had completed participating in the Project Challenge intervention.

Dialogic Teaching

Robin Alexander (2010) like Resnick and colleagues (Michaels & O'Connor, 2011; Resnick, Michaels, & O'Connor, 2010) recognised the power of talk to stimulate and extend students' thinking and advance their learning and understandings. Through a similar dialogic approach that he called Dialogic Teaching, teachers encourage students to engage in reciprocal dialogues where they openly exchange views and information, explore issues, interrogate ideas, and tackle problems in a social or small group environment that is supportive of these discussions. The focus is to build on the ideas of others and through joint acts of meaning-making, co-construct and create new knowledge and understandings.

Dialogic teaching involves improving students' powers of communication through a broad repertoire of strategies and techniques that the teacher can employ in different educational contexts and for different purposes to facilitate learning (Alexander, 2010; Wolfe & Alexander, 2008). These strategies and techniques include ensuring that authority over the content and form of discourse is shared; questions are open or divergent; students are provided with meaningful and specific feedback; students are encouraged to reflect on both the product and the processes of the discussion (meta-level reflection); students provide explanations; and, students engage in collaborative co-construction of knowledge (Reznitskaya, 2012).

Mercer, Dawes and Staarman (2009) investigated how two primary teachers who used dialogic teaching to explore students' current understandings of science, build links between past experiences and current ones, and explicitly teach how talk can be used to reason together and develop shared understandings. The results showed that the more students' views were sought and valued during the dialogic exchanges, the more motivated they became and the more they engaged in the topic under discussion. Similar results were reported by Reznitskaya et al (2012) who found that dialogic interactions were enhanced in a cohort of students who had experienced dialogic teaching than a cohort of peers who participated in regular classroom discussions. Students who experienced dialogic teaching took more responsibility for the topics to be discussed and the questions that they asked, including asking many that were cognitively challenging and contestable. Furthermore, in the dialogic classrooms, teachers prompted students to relate their ideas to the arguments of their classmates more often than the teachers in the regular classrooms.

Rojas-Drummond et al. (2013) reports on how 'dialogic scaffolding', a form of dialogic teaching, was used by teach-

ers to gradually lead students to a better understanding of the topic on HIV virus that they were discussing. It was interesting to note that as the students' dialogue evolved and became more complex, the students' mental maps of the HIV virus became more complete, complex, and detailed. This led the authors to surmise that the students' progress was partly promoted by the teacher's adjusted and crafted interventions in response to the students' initiatives and replies while the interactions among the students qualified as 'dialogic' because they represented a variety of communicative acts such as questioning, explaining, supporting, and discussing. Rojas-Drummond et al. noted that while dialogue plays a crucial role in students' learning and development, education is enacted through interactions between teachers and students.

Howe (2013b), in a review of four studies on scaffolding involving abstract thinking, argues that teachers need to make extensive use of group work amongst students, to select groups that require abstraction and trigger differences of opinion, and use scaffolding to support students as they move towards resolving the problem under discussion. Part of this support involves teachers coaxing groups to explain their reasoning and via gently probing move students gradually towards superior analyses while simultaneously allowing space between scaffolding and task completion to enable them to assimilate the scaffolded message and use this information in adjusting their own understandings. The findings from research on dialogic teaching (Alexander, 2010; Howe, 2013a, b; Mercer et al., 2009; Rojas-Drummond et al., 2013) led Reznitskaya (2012) to argue that when teachers make their classroom interactions more dialogic, they have the potential to engage students in collaborative deliberations of complex questions that support the development of students' thinking and knowledge construction.

Exploratory Talk

Another form of dialogic talk is Exploratory Talk which emerged from Mercer's (1996) observational studies on the different ways students talk and think as they interact together. The first way involves disputational talk which is characterised by disagreement and individual decision making with few attempt to pool resources or offer constructive criticism. The second way involves cumulative talk where speakers build positively but uncritically on each other's ideas. This type of talk is characterised by repetitions, confirmations, and elaborations while the third way involves exploratory talk where partners engage critically but constructively with each other's ideas. In this type of discourse, Mercer maintains, "knowledge is made more publically accountable and reasoning is more visible in the talk" (p.369).

In exploratory talk, students are taught how to engage critically and constructively with each other's ideas by learning how to reason and justify their assertions and opinions as they collaborate on group-based tasks (Mercer, Wegerif, & Dawes, 1999). The ground rules needed to generate ex-

ploratory talk during small group discussions include: sharing all information; aiming to reach consensus among group members; accepting responsibility for group decisions; providing reasons for decisions; discussing alternative propositions; and, encouraging contributions from everyone.

While students need to learn the protocols for engaging in exploratory talk, Rojas-Drummond and Mercer (2003) emphasised the key role that teachers play in creating the conditions that will enable dialogic exchanges to occur. This includes helping students to make their thoughts, reasons and knowledge explicit and share this information with the class. It also includes modelling different ways of using language that children can appropriate for themselves, and providing opportunities for children to make longer contributions in which they express their understandings or articulate their difficulties. The results from this study on the use of exploratory talk showed that while it enabled students to become more effective in using language as a tool for reasoning and sharing knowledge, it also led to higher levels of individual achievement, and significant improvements in students' capacities to solve reasoning-test problems. These results are consistent with the findings of Mercer, Wegerif, and Dawes (1999) who concluded that "the use of exploratory talk helps to develop children's individual reasoning skills. It appears that even non-verbal reasoning, like that involved in solving the Raven's problems, may be mediated by language and developed by adult guidance and social interaction amongst peers without the provision of any specific training in solving such problems" (p. 108). Mercer et al. also noted that "...our results support the view that the induction of children into cultural language practices influences their use of language as a cognitive tool" (p. 108).

Philosophy for Children: An approach to dialogic teaching

Others who have found that dialogic interactions promote the development of critical and creative problem-solving and enhanced cognitive ability include Trickey and Topping (2004, 2006). Using Philosophy for Children (P4C) (Lipman, 1988) which is an approach to teaching students how to think for themselves and make informed choices, the authors investigated the effects of this approach to dialoguing on students' academic, social, and cognitive abilities as they worked together as a "community of enquiry" investigating topics with their class peers. P4C teaches students how to communicate cognitively with each other as well as how to use social and emotional communication skills and includes helping students to develop empathy and sensitivity to the feelings of others. The authors argued that engagement in P4C could also be expected to enhance self-esteem and self-efficacy as well as developing social and emotional intelligence. Indeed, this was so with Trickey and Topping (2006) finding that participation in P4C across a seven months period led to significant gains in self-esteem, including a significant reduction in dependency and anxiety and greater self-

concept among participating students in comparison to their control peers.

In a further study, Topping and Trickey (2007a) investigated the effects of P4C implemented for one hour per week across a 16 month period on 10-12 year old students. The results showed that students who participated in P4C showed significant gains in verbal and non-verbal standardized tests of reasoning ability that were consistent across schools and largely irrespective of ability or gender. The study showed that it is possible to intervene effectively in the cognitive development of primary aged children by using P4C for one hour per week. Furthermore, Topping and Trickey (2007b) found that these gains were maintained when students were followed up two-years later when they had transferred to secondary school even though they had not received further instruction in P4C. Interestingly, students in the control group showed a persistent deterioration in their scores from pre- to post-test to follow up across the same time period. Similar results were reported by Topping and Trickey (2007c; 2013) who found that a structured and scaffolded P4C program implemented over time contributed to enhanced reciprocal communicative interactions between teachers and students and students and students in the classroom with teachers generally asking more open questions to encourage student participation and students, in turn, talking more and demonstrating more elaborate thinking when contributing to the discussions. The authors surmised that these interactions seem likely to have contributed to the summative cognitive gains also found in this study. In short, Trickey and Topping and Topping and Trickey demonstrated that instruction in P4C leads to social, emotional and cognitive gains and that these gains are maintained and transfer across schools and subject areas.

Interactions promoting learning

While it is important to know how different dialogic approaches can enhance students' interactions and learning and the effects they have on students' social, emotional, and cognitive development, it is also important to understand how students' interactions promote understanding and learning during collaborative group discussions. In a series of studies Webb and colleagues (Webb, 2009; Webb & Farivar, 1999; Webb & Mastergeorge, 2003; Webb, Troper, & Fall, 1995) found that providing elaborated help in response to requests for help was positively related to achievement whereas statements containing unelaborated responses were not. Webb and colleagues also found that receiving explanations when they were not requested was usually negatively related to achievement, possibly because the recipient may not have perceived that he or she needed the help, may not have realised the relevance of the help, or may not have had the opportunity to apply the help to the problem at hand.

Drawing on previous studies about how students respond to help while working in collaborative groups, Webb and Mastergeorge (2003) identified a core group of student

interactive behaviours that are necessary for effective helping. For helpees, there were three types of behaviours that were associated with successful learning. These included asking precise questions so helpees are able to indicate specifically what they do not understand, persisting in asking for help until they receive the help that they need and, applying the help received to the problem at hand. Helpers, on the other hand, needed to provide detailed explanations, ensure that helpees have opportunities to apply the help received and, they also need to monitor helpees as they apply the help to the problem they are trying to resolve.

In a more recent study, Webb et al. (2013) explored the relationship between student participation in classroom conversations, teacher practices, and student learning in elementary school mathematics classrooms. In particular, the study sought to investigate how students engage with each other's ideas and explain their own thinking to their peers. The study also sought to document how teachers, in their dialogic interactions with their students, promote different degrees of student engagement with the details of each other's ideas. The study involved 111 grade 3-4 children and their teachers from six classrooms in one school. The results confirmed previous findings that giving fully detailed explanations was significantly correlated with achievement scores. Interestingly, students who engage with each other's ideas at a high level (i.e., by extending ideas) showed high achievement regardless of the level of the others' engagement while the achievement outcomes for students who engaged at a medium or low level with others' ideas was related to the level at which other students engaged with them and their ideas. In essence, Webb et al. concluded that while giving detailed explanations may be important for achievement, it is not sufficient of itself. What appears to be predictive of achievement is the extent to which students engage in each other's thinking.

While understanding the effect student engagement with each other's ideas has on student achievement is important, Webb et al. (2013) also sought to identify how teachers promoted student engagement with others' ideas in their classrooms. Data collected from observing teachers interacting with students in their classrooms showed that while teachers asked a variety of questions to help students to attend to the ideas of others, what was important was the way teachers followed up on students' responses by pressing them to explain their thinking so others had a clearer understanding of how they had solved the problem. It also included asking students to identify how their thinking differed from explanations others had provided or helping them to recognize similarities between other suggestions or ideas. In effect, Webb et al. are challenging students to think about how others are thinking and how the thinking of others diverges from their own and in so doing, students are being pressed to think metacognitively about the topic under discussion and to make their thinking explicit. There is no doubt that dialogue and discussion around contentious issues helps children to generate more sophisticated and creative answers

to challenging questions than children working alone which lead to new cognitive understandings as children search for logical coherence (De Lisi & Golbeck, 1999; Gillies et al. 2012).

Conclusion

The purpose of this paper has been to review developments in research on cooperative learning and to examine the factors that mediate and moderate its success. In particular, the paper focused on the key role talk plays in developing students' thinking and learning. The paper reviewed the research on cooperative learning beginning with the work of Lewin (1947) who recognized the dynamic nature of groups and the importance of investigating the relationship between group members if the behaviour of the group was to be understood. Building on Lewin's work, Deutsch (1949a, b) investigated interactions between individuals and group processes that developed as a consequence of cooperation or competition and the effect these conditions had on students' working relationships, attentiveness, personal attraction, interpersonal communication, motivation, and productivity.

From the beginning of the 1970s empirical studies began to emerge on the social and academic benefits students derived from working together. These studies included research by David and Roger Johnson (2000, 2002, 2003) and their colleagues (Johnson et al., 1981), Shlomo Sharan and his colleagues (1990, Sharan et al., 1990; Shachar et al., 1990) and Robert Slavin and his colleagues (1999, 2008). While each developed their own interpretation of cooperative learning, all agreed that provided this pedagogical approach to working together was well-structured and correctly implemented, students benefited from this approach to learning (Sharan, Y., 2010).

In recent years, interest in the key role 'talk' plays in the construction of knowledge, understanding and learning has gathered momentum as studies have emerged that demonstrate the importance of social collaboration in promoting cognitive development and academic attainment. Included in this corpus of studies is the role of cognitive acceleration programs in promoting students' meta-cognitive thinking and learning (Adey & Shayer, 1990, 1993, 1994) and the different dialogic teaching and learning approaches advocated by Mercer (1996, 2008) such as Exploratory Talk (Mercer et al., 2009), Accountable Talk by Resnick (Resnick et al., 2010), Dialogic Teaching by Alexander (Alexander, 2010), and Philosophy for Children by Topping and Trickey (Topping et al., 2007 a, b, c).

While it is important to know how different dialogic approaches enhance students' interactions and learning and the effects they have on students' social, emotional, and cognitive development, it is also important to understand how students' discussions during collaborative group discussions promote understanding and learning. In a series of studies Webb and colleagues (Webb, 2009; Webb & Farivar, 1999; Webb & Mastergeorge, 2003; Webb, Troper, & Fall, 1995)

found that students need to provide elaborated help when such help is sought and they need to ensure that the recipient of this help understands it and can apply it to the problem at hand. Furthermore, teachers need to create conditions in their classrooms that press children to explain their thinking and to challenge other students to consider the diverse ideas of others. In short, Webb et al. believes students need to be taught how to think metacognitively and to make their thinking explicit. As children seek to reconcile their ideas with the ideas of other they often generate new cognitive understandings and more sophisticated and creative ways of thinking.

In summary, while cooperative learning is well recognized as a teaching strategy that promotes learning and so-

cialization, research also shows that students have much to gain when they have opportunities to engage in reciprocal dialogues where they learn to listen to others' ideas, ask questions, interrogate topics, and draw inferences. Furthermore, if teachers create conditions where students are pressed to explain their thinking, students are more likely to demonstrate more strategic and metacognitive thinking and, in so doing, make their thinking more explicit as the link between strategy use and learning is emphasized.

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