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Cooperative Learning with Gifted and High-achieving Students: a review and meta-analyses of 12 studies

HEINZ NEBER, MONIKA FINSTERWALD & NICOLA URBAN

Should gifted and high-achieving students cooperate in homogeneous groups or do they learn better individually? Or should they learn together with less gifted peers in heterogeneous groups? Current empirical research is reviewed in this article and meta-analyses of available results in 12 published studies are performed. Results show that few methodologically sound studies can be found at present. In addition, researchers only considered a restricted spectrum of participants, focused on learning of relatively simple materials, measured only a restricted range of possible outcomes, and neglected processes and activities of the learners, which might determine outcomes of cooperative learning. Results therefore remain controversial even for fundamental issues like learning in homogeneous versus heterogeneous, mixed-ability groups. In spite of these limitations, analyses nevertheless show that cooperative learning offers strong potentials for further improving the quality of instruction with gifted and high-achieving students. Further empirical research is required to obtain more differentiated information on the various aspects of cooperative learning.

Cooperative Learning

Learning can be considered a dynamic process in order to attain preferred goals like getting high grades or acquiring knowledge and skills. The attainment of such goals in small groups depends on the interdependencies among the members of the group. For learning groups, Deutsch (1949) distinguished several basic types of *goal interdependency*. Positive goal interdependency is the defining characteristic of cooperative learning in which each member contributes to the success of all other members of the group. Achievements correlate positively and all participants can attain preferred goals, like, for example high grades, simultaneously. In contrast, negative goal interdependency is the defining characteristic of competitive learning. The achievements of members in competitive groups correlate negatively and the attainment of preferred goals by one or a few members precludes comparable attainments by others. Yet another schema for organising the dynamics of goal

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attainment is individualistic learning. It is characterised by non-existing interdependencies, and individual achievements of learners are neither positively nor negatively correlated (Neber, 1994).

Numerous investigations done resulted in advantages for cooperatively versus otherwise organised learning. Positive effects have been found for cognitive achievements and cognitive development, motivation, and aspects of the learning environment like group cohesion and the perception of the social climate in groups or classroom (Johnson & Johnson, 1988, 1995; Johnson *et al.*; Slavin, 1991). Such effects have been found with homogeneously grouped gifted children as well. Johnson and Johnson (1993) compared cooperative versus individualistic learning of high-ability elementary school students. Cooperatively organised learning resulted in higher achievements and more positive academic self-concepts.

These positive cognitive, motivational, and social outcomes are explained by specific epistemic—or knowledge-generating—communicative events and processes. Compared to competitive learning, cooperative learning fosters productive cognitive conflicts among the participants, exchanges of needed resources, mutual help and support and verbal interactions like questions and explanations. It also contributes to sustain an optimal activation level (Johnson *et al.*, 1995; Webb, 1988). Such events and processes are considered as mediating the effects of group effectiveness for they enable social facilitation, the externalisation of thinking processes, comparisons of different perspectives, and mutual social monitoring of learning (Dillenbourg *et al.*, 1995).

The new wave of cooperative learning and peer-based instruction corresponds to actual epistemologies, which view *cognitive activities as social phenomena*, and to situated paradigms of learning (Levine *et al.*, 1993). Accordingly, learners jointly discover and generate knowledge in a social environment (Hatano & Inagaki, 1991; Inagaki & Hatano, 1988; Neber, 1999). Group discovery methods effectively implement such shared cognition approaches by distributing work among participants (Robertson *et al.*, 1994; Neber, 1998). Applications of such cooperative methods aim at maximising the interactions between the learners, thus keeping epistemic activities like mutual questions and explanations on high levels (Neber, 1995). Methods for organising the interaction in cooperative groups like group discovery (Robertson *et al.*, 1994), Jigsaw (Aronson *et al.*, 1978), or Student Teams-Achievement Divisions—STAD (Slavin, 1994) determine the intensity of epistemic interactions among members of a group, and thus the learning efficiency of the group and its individual members.

Another aspect which determines epistemic activities of participants in cooperative learning is the composition of the group. In gifted education, *group composition* is the most discussed issue, with a clear tendency towards recommending mixed-ability groups. According to Slavin (1994), Johnson *et al.* (1988), and Dar and Resh (1986), gifted students should learn cooperatively together with less able peers. This recommendation corresponds to Webb's (1992) findings of higher qualities of students' explanations in heterogeneous groups and poor qualities of explanations in homogeneous groups of high-ability students. According to Dillenbourg *et al.* (1995), heterogeneity enables productive social conflicts, which initiate knowledge-generating epistemic activities.

Nevertheless, Salomon and Globerson (1989) made clear that possible negative social effects may corroborate the expected advantages of cooperative learning in mixed-ability groups by reducing the frequency of epistemic interactions among the members of those groups. Such detrimental effects are explained by negative influences of heterogeneous group composition on motivational processes. Motivations of poor learners in mixed-ability groups could be reduced by the free-rider effect, which means that poor learners remain passive whereas highly able learners do all the work, thus profiting most by joining such groups. In contrast, highly able learners may suffer in joining mixed-ability groups from "the sucker-effect", for they feel exploited as tutors of the lesser able and thus reduce their activity level (Robinson, 1990; Ross & Smyth, 1995). The ganging-up effect represents another effect that influences motivation negatively. This means that the whole group adopts a work-avoidance tendency, spending as little effort as possible in dealing with the learning tasks. Some educators of gifted and talented learners are convinced that curricular units for mixed-ability groups generally do not challenge gifted students as needed (Gallagher, 1993). Ross and Smyth (1995) concluded that cooperative learning must be intellectually demanding for gifted learners. Ediger (1994) admits that gifted students should be given the opportunity to work with average and low-ability students in teams, but they also should experience a special curriculum that stresses higher levels of cognition such as critical or creative thinking. He points out that gifted students have unique needs concerning the cognitive level of work, and they should be provided with an adequate curriculum.

Thus, findings and discussions on the adequacy of cooperative learning for highly gifted learners remain rather controversial (Renzulli, 1997). This applies especially to recommendations for cooperative learning in mixed-ability groups. It seems that the consistently reported positive effects for cooperative learning with average or poor students have been more or less taken for granted for highly gifted students. This might be an overgeneralisation of findings, however, for only few studies really investigated this issue (Heller, 1999). For instance, only one study clearly demonstrated positive effects of cooperative learning in heterogeneous, mixed-ability groups compared to an alternative pull-out enrichment programme which organised gifted learners in homogeneous groups (Stevens & Slavin, 1995).

The purpose of this article is to review recent empirical studies on cooperative learning. The original intention was to consider only investigations which included samples of highly gifted students. This constraint was weakened, however, since only few publications could be found which included such samples. The review thus covers studies on cooperative learning of highly gifted students as well as of high-achieving students.

Method

In order to survey the spectrum of empirical work on cooperative learning with gifted and high-achieving students, database searches from 1982 to 1999 were performed. The searches covered ERIC (1982–1999), PSYCLIT and PSYNDEX (a German database). Cooperative learning, collaborative learning, learning environ-

ment, gifted students, high ability, high achievers, and high achievement were taken as keywords for searching these databases. Results for gifted and for high-achieving students were considered. Despite the fact that many gifted students are high achievers, both groups might differ in determinants and effects of cooperative learning. Therefore, results on cooperative learning are presented separately for groups of gifted and of high-achieving students.

Furthermore, studies were further analysed if cooperative learning groups were compared to other organisational frameworks or if different compositions of cooperative groups were compared. In all of the selected studies, gifted or high-achieving students were involved, and separate effects for these groups were reported. Note, however, that studies were excluded which did not report quantitative data (e.g. Gillies & Ashman, 1996; Melser, 1999) or only measured attitudes toward cooperative learning without comparing it to other organisational frameworks (e.g. Li & Adamson, 1992; Neber, 1995; Ramsay & Richards, 1997).

Applying these search criteria, 12 studies where chosen. It seems that only few studies between 1982 and 1999 treated cooperative learning of gifted and high-achieving students on a methodologically sound level. Most remarkably, only three studies included gifted students. For its importance for cooperative learning with gifted students, a fourth study was considered, even though it did not include a control group. Nevertheless, with eight results, the majority of the reviewed research included high-achieving students (Table 1).

Only one study investigated cooperative learning in groups of highly gifted students who had been classically identified by intelligence tests (Kanevsky, 1985). All other studies were concerned with learning in mixed-ability groups of students, contrasting either different organisational schemes (cooperative, individualistic, or competitive) or comparing cooperative learning of gifted students in mixed-ability versus homogeneous groups.

Studies could be classified according to their focus on the processes or on the outcomes of cooperative learning. Only a few studies measured process variables related to the learning activities in the groups (e.g. interactions of the participants). In contrast, outcome variables were always considered, with a clear emphasis on variables measuring final achievements and learning performances of the groups and their members, whereas non-cognitive outcomes concerning attitudes, beliefs, motivations and characteristics of the self-system seem to be rather neglected issues in these studies (Table 2).

These studies will be separately analysed for findings with gifted students in homogeneous groups and for gifted or high-achieving students in heterogeneous groups. Because of the small number of only four studies with identified gifted students, these will be presented and discussed as individual cases.

Meta-analysis

The larger number of results with high-achieving students, however, allows for meta-analysis of several effects of cooperative learning. Note that meta-analyses with relatively few studies are common in the field of gifted education, e.g. Vaughn *et al.*

Table 1. Cooperative learning of gifted and high-achieving students in homogeneous and heterogeneous groups: an overview of studies used in this review.

	Studies involving homogeneous cooperative groups	Studies involving heterogeneous cooperative groups	
	Cooperative vs. competitive learning	Cooperative vs. individual learning	Heterogeneous vs. homogeneous groups
Gifted students High-achieving students	Kanevsky (1985)	Smith *et al.* (1982) Dalton *et al.* (1989)	Kenny (1995) Hooper (1992)
		Hooper (1992)	Hooper & Hannafin (1991)
		Hooper & Hannafin (1991)	Hooper & Hannafin (1988)
		Johnson *et al.* (1993)	Knupfer & Nelson (1993)
		Simsek & Hooper (1992)	Webb *et al.* (1998)
		Webb *et al.* (1998)	

(1991) based their meta-analyses of pull-out programmes on nine experimental studies.

For studies which reported descriptive statistics of experimental and control groups, effect sizes were computed according to Bortz and Döring (1995). Effect strengths were therefore calculated as Δ-values, which can be further used like correlation coefficients. Homogeneity tests were applied to test that the studies considered referred to the same hypotheses. Significant results of these tests allow a meaningful interpretation of the mean effect sizes. According to Bortz and Döring (1995), small effects correspond to $\Delta \leq 0.3$, moderate effects to $\Delta \leq 0.5$ and large effects to $\Delta > 0.5$. These values represent the strength of the relationship between two variables (e.g. cooperative learning format and achievement as outcome variable).

Results

Cooperative Learning with Gifted Students

The searches in the databases resulted in four studies involving identified gifted and highly gifted students as participants.

Kanevsky (1985) evaluated a pull-out programme for highly gifted third- and fourth-grade students. Effects of three instructional approaches to organise the learning of these students were compared. These involved randomly assigned traditional, cooperative and competitive group work in mathematics. Under each condition, third and fourth graders worked together in pairs, solving mathematics tasks for 15 minutes on each of 10 consecutive days. The participants were

Table 2. Variables measured in studies on cooperative learning of gifted and high-achieving students

	Groups of variables	Measures	Study
Processes	Activities in the groups	Cooperative, individualistic, competitive behaviours	Elmore & Zenus (1994) (G,—)
		Time on task	Hooper (1992) (A, IC, HH)
		(Non) task oriented interactions	Hooper & Hannafin (1991) (A, IC, HH)
		Discussion quality	Smith *et al.* (1982) (G, IC)
		Offer/seek help (from peers, teacher, computer tutors)	Webb *et al.* (1998) (A, IC, HH)
Outcomes	Achievement	Achievement test	Dalton *et al.* (1989) (A, IC)
		Problem-solving	Elmore & Zenus (1994) (G,—)
		Retention	Hooper (1992) (A, IC, HH)
		Number of completed tasks	Hooper & Hannafin (1988) (A, HH)
			Hooper & Hannafin (1991) (A, IC, HH)
			Hooper, Temiyakarn & Williams (1993)
			Johnson *et al.* (1993) (A, IC)
			Kanevsky (1985) (G, CC)
			Kenny (1995) (G, HH)
			Knupfer & Nelson (1993) (A, HH)
			Simsek & Hooper (1992) (A, IC)
			Smith *et al.* (1982) (G, IC)
			Webb *et al.* (1998) (A, IC, HH)
	Attitudes	Attitude towards instructional method (cooperation, individualism, competition)	Dalton *et al.* (1989) (A, IC)
			Johnson *et al.* (1993) (A, IC)
			Kanevsky (1985) (G, CC)
			Kenny *et al.* (1995) (G, HH)
		Attitude towards peers	Simsek & Hooper (1992) (A, IC)
	Motivation and self-concept	Academic self-esteem	Elmore & Zenus (1994) (G,—)
		Self-perception	Johnson *et al.* (1993) (A, IC)
			Kenny *et al.* (1995) (G, HH)
			Smith *et al.* (1982) (G, IC)
	Group characteristics	Group cohesion	Johnson *et al.* (1993) (A, IC)

Legend. G = study with gifted students; IC = individual vs. cooperative learning; A = study with high-achieving students; HH = homogeneous vs. heterogeneous grouping; CC = competitive vs. cooperative learning; — no control group

instructed to improve their individual and their team scores. Learning performances and preferences for cooperative versus individual and for cooperative versus competitive learning were measured as outcome variables. The learning conditions resulted in comparable learning performances (competitive: $\Delta = 0.25$; cooperative: $\Delta = 0.14$ and traditional: $\Delta = 0.20$). Additionally, competitively organised dyads resulted in increased preferences for competitive learning and a reduction of preferences to learn cooperatively.

Elmore and Zenus (1994) evaluated an acceleration programme with 30 highly gifted sixth graders learning arithmetic in teams. The teams were organised according to "Jigsaw II": Slavin's modification of the original Jigsaw. In addition, the participants were trained in cooperative skills like encouraging team members, effective listening, asking and giving help. Pre- and post-test changes were measured for arithmetic achievement ($\Delta = 0.27$), self-esteem ($\Delta = 0.18$) and social competence ($\Delta = 0.22$). All of these positive changes were significant and low achievers among the highly gifted students profited most from this version of cooperative learning. Yet, whether the cooperative organisation of learning or the additional training in social skills caused these effects remained unclear.

Two other studies including gifted students tried to find answers to the question

whether gifted students should learn in homogeneous groups or together with non-gifted students in heterogeneous groups.

The study of Smith *et al.* (1982) included 14 identified highly gifted students in a total sample of 55 sixth graders. These participants either learned individually or in heterogeneously composed groups of four with at least one highly gifted student in each of the groups. Students dealt with one instructional unit on ecology (soil conservation and land use) on each of five consecutive days. As process variables, peer interactions were measured and as outcome variables, retention performances as well as problem-solving achievements related to the instructed topics were measured. Cooperative learning in mixed-ability groups resulted in more positive interactions and in higher learning performances than individual learning.

The fourth study included 229 highly gifted and 557 non-highly gifted fourth graders (Kenny, 1995). The highly gifted students either learned in homogeneous groups with other highly gifted peers or in mixed-ability groups together with non-gifted peers. Learning achievements and socio-emotional variables like attitudes towards peers and self-esteem were measured as outcome variables. Highly gifted students' learning achievements were comparable under both conditions. In all other respects, learning in heterogeneous groups turned out to be more effective for highly gifted learners. After learning in such groups, they were regarded as more friendly and better leaders by their peers; additionally, the social self-concept of the highly gifted learners was more positive than after individual learning.

None of the results of the four studies was negative for cooperative learning with gifted students. On the contrary, with the exception of Kanevsky (1985), all other studies found positive effects in favour of cooperative learning. Most pronounced were the consequences for attitude and self-system variables as well as for social interactions. Therefore, cooperative learning with gifted students seems to be effective for non-cognitive outcomes and mixed-ability groups may increase these effects.

Nevertheless, and despite the intensive discussions in the domain of gifted education, only a few pieces of the large puzzle of cooperative learning with gifted students have been empirically studied. The investigations reviewed considered only elementary school students as participants. Even these few studies suffer some methodological weaknesses. Non-comparable schemas were applied to organise cooperative learning, mostly without adequately controlling positive goal interdependence of the members of the groups. Therefore, conclusions and recommendations concerning conditions and effects of cooperative learning with gifted students may not be derived from current research.

Cooperative Learning with High-achieving Students

The database searches resulted in eight studies investigating cooperative learning with samples of high-achieving students. Although some of these authors preferred the term "high ability" to label participants, achievement measures were used to determine the samples investigated. Table 3 gives an overview of important charac-

teristics of the participants, grouping practices, instructional settings, topics, and assessments.

Some serious restrictions of these studies are obvious. First, as was the case with gifted students, studies with participants in higher grades, especially at senior high school level, are completely missing. Investigations focused on cooperative learning of high-achieving middle school students. Second, another limiting characteristic is the preference for rather short interventions. Only three of the eight studies implemented cooperative formats of instruction which lasted longer than 2 hours. Third, cooperative learning of a restricted range of topics was investigated and only mathematics and science were considered as subjects of learning. Fourth, in most of the studies, the participants had to acquire only elementary knowledge. Therefore, possible advantages of cooperation in acquiring complex knowledge and in learning by project-oriented investigations remain unclear. Fifth, similar to studies on cooperative learning of highly gifted students, non-comparable schemas were applied to organise cooperation among high-achieving students. Only Johnson *et al.* (1993) used a proven procedure to control positive goal interdependency.

The investigations clearly focused on two issues: (i) cooperative learning in heterogeneously composed groups of learners at different achievement levels versus individual learning of high achievers; and (ii) cooperative learning in such heterogeneously composed groups versus cooperative learning in homogeneous groups of high achievers. No study was found dealing with cooperative learning in homogeneous groups versus individual learning of high achievers. Table 4 summarises the findings for both kinds of comparisons separately for process and outcome variables. Effect sizes were calculated for studies and comparisons which communicated the necessary data.

Higher learning performances are attained if high achievers learn together with low-achieving students in heterogeneous groups rather than learning individually. A mean effect size of 0.26 for achievement as dependent variable (calculated on a basis of $n = 302$ high achievers) can be taken as a clear positive result for cooperative learning in such groups. The homogeneity of variances ($p \leq .01$) *indicates that the summarised individual results really test the same hypothesis. Several studies, for example Simsek and Hooper (1992), even found large positive effects in favour of cooperative versus individual learning of high achievers.*

In respect to other outcome variables, the findings were not as clear as for achievement. Besides some non-significant results, only Johnson et al. (1993) attained significant positive increases in preferences for cooperative versus individual learning of high achievers after they had participated in cooperative learning groups. Likewise, a more positive self-esteem resulted for these students. Yet, mean effect sizes for outcome variables other than achievement could not be calculated because of missing data in these publications.

As already found for studies involving gifted learners, process variables were not extensively investigated in studies on cooperative learning with high-achieving students. In addition, most of these studies did not report any significant differences between cooperatively versus individually organised learning of high-achieving students.

Table 3. Summary of studies on cooperative learning of high-achieving students

Authors	Students	Criterion for high ability	Characteristics of learning and instruction	Assessments
Hooper (1992)	5th and 6th graders ($n = 115$)	Split on a standardised achievement test: high (above 85th percentile in CAT) and low ability students	Pre-training in communication skills One computer-based session on arithmetic symbol system (1.5 hrs.) Cooperative groups of four students; role switching based on cooperative scripts	Observation of group interactions (transactions, helping, social comments) Time on task Number of completed tasks Achievement test performance
Hooper & Hannafin (1991)	6th and 7th graders ($n = 125$)	High and low ability students based on a math subtest of a standardised achievement test	Two pre-instructional training sessions in cooperative skills One computer-based instruction (CBI) (45 minutes) on arithmetic symbol system Cooperative pairs (dyads)	Achievement test performance (fact, application, problem-solving) Observation of interactions Instructional efficiency (quizzes completed)
Johnson *et al.* (1993)	5th graders ($n = 32$	High achievers based on top 25% of a reading achievement test	Pre-instruction in cooperative skills Teacher training Six science classes (55 minutes each)	Achievement test performance (recall and reasoning tasks) Attitudes towards instructional methods Academic self-esteem Group cohesion
Webb *et al.* (1998)	8th graders ($n = 445$; 80% in cooperative groups)	Low, medium-low, medium-high, high "ability" students based on a composite of different achievement tests	Pre-instructional 3-week unit in regular science classroom (topic: introduction to electrical circuits) Then one class: cooperative work on assignments in groups of three students	Achievement test performance Discussion quality Behavior in groups

Table 3. *Continued*

Authors	Students	Criterion for high ability	Characteristics of learning and instruction	Assessments
Dalton *et al.* (1989)	8th graders ($n = 60$)	High and low "ability" students based on school achievement tests	Pre-instruction session in communicative skills and computer literacy One CBI lesson on human anatomy and physiology (30 minutes) Mixed-ability pairs (dyads)	Achievement test performance Survey of attitudes towards instruction and lesson content
Simsek & Hooper (1992)	5th and 6th graders ($n = 30$)	High and low "ability" students based on median split in a science achievement test (Science Research Associates Test)	Pullout program Video-based biology (two hours) Cooperative learning in mixed-ability triads	Achievement test performance Time on task Attitudes towards instruction and group work
Hooper & Hannafin (1988)	8th graders ($n = 40$)	High ability students: those who attend accelerated pre-algebra class Average ability students: those who attend regular mathematics class	One CBI lesson (45 minutes) on arithmetic symbol system Collaborative groups of four students Script-based collaboration with prescribed role switches	Achievement test performance: low-level fact recall and high level application problems
Knupfer & Nelson (1993)	6th graders ($n = 50$)	Low, average, and high "ability" students based on previous mathematics achievement	Classrom instruction in LOGO basics (13 hours) CBI LOGO training (52 hours programming of geometric problems): cooperative work in pairs (dyads)	Achievement test performance

Table 4. Cooperative learning of high-achieving students: comparisons with individual learning and effects of group composition

Comparisons	Dependent variables		Study	*n*	Effect size
Cooperative learning in heterogeneous groups vs. individual learning	Processes	Activities in the groups	Hooper (1992)* Hooper & Hannafin (1991)† Webb *et al.* (1998)*		
	Outcomes	Achievement	Dalton *et al.* (1989)	39	0.47
			Hooper (1992)	99	0.15
			Hooper & Hannafin (1991)	31	0.10
			Simsek & Hooper (1992)	14	0.55
			Johnson *et al.* (1993)	32	0.41
			Webb *et al.* (1998)	99	−0.15
		Attitudes	Dalton *et al.* (1989)† Johnson *et al.* (1993) cooperative learning:	32	0.45
			individualistic learning:	32	−.21
			Simsek & Hooper (1992)†		
		Motivation and self-concept	Johnson *et al.* (1993)	32	0.22
		Group characteristic: group cohesion	Johnson *et al.* (1993)	32	0.28
Homogeneous vs. heterogeneous grouping	Processes	Activities in the groups	Hooper (1992)* Hooper & Hannafin (1991)† Webb *et al.* (1998)*		
	Outcomes	Achievement	Hooper & Hannafin (1991)	30	0.08
			Hooper & Hannafin (1988)	22	0.08
			Hooper (1992)	36	0.22
			Knupfer (1993)	18	0.19
			Webb *et al.* (1998)	108	0.52

* values for computing effect sizes are missing; † differences were not significant.

The five studies which compared cooperative learning of high achievers in homogeneous versus heterogeneous groups are described next.

For processes, Hooper (1992) found that high-ability students gave and received more help in homogeneous than in heterogeneous groups and they spent more time on the task in homogeneous groups. In contrast, Hooper and Hannafin (1991) found no significant differences for frequencies of cooperative interactions in homogeneous versus heterogeneous groups. In the study of Webb *et al.* (1998), effects on activities of high achievers in heterogeneous groups remain unclear.

For achievement as outcome, a mean effect size could be calculated. The resulting $\Delta = 0.22$ ($p < 0.005$, $n = 214$) shows that high achievers should learn cooperatively in homogeneous groups. This seems to foster the learning performances of those

students better than cooperatively learning together with low-achieving students in heterogeneous groups. Remarkably, no data could be found for other outcome variables than achievement.

In sum, the available findings indicate that high achievers' performances improve if they learn in *homogeneous* groups with other high-achieving students. Lower performances result if these students either learn *individually* or together with lower achieving students in *heterogeneous* groups. Most of the studies included in this review focused on measuring consequences of cooperative learning on achievements of the participants, whereas other possible outcomes of cooperative learning were not adequately considered in these studies. This applies to motivational, attitudinal and self-system related outcomes as well as to social and leadership skills. In these respects, only positive effects of cooperative learning could be expected. Thus, current research does not fully cover the range of possible advantages of cooperative learning.

Discussion

The review of studies as well as the meta-analyses indicate that cooperative forms of learning can result in small to medium positive effects on learning achievements of gifted and high-achieving students in lower and middle grades. At the same time, current research is insufficient for deriving more precise and detailed recommendations for how to implement cooperative learning with high-ability learners. Too limited a number of studies is available; the investigators have focused on a narrow range of topics, neglecting important issues, and even within these limitations, inconclusive results were found. For instance, studies with gifted students point to advantages for cooperative learning in heterogeneously composed, mixed-ability groups, whereas studies with high achievers found clear advantages for cooperative learning in homogeneous groups. Therefore, the available empirical data do not even allow us to answer one of the most intensely discussed questions, whether or not high-ability learners should cooperate in heterogeneously composed groups with lower ability learners to attain high-level learning objectives (cf. Slavin, 1991).

Another weakness of the current research is a lack of explanatory, theory-oriented studies. Even though it could be shown that epistemic activities like exchanging questions and explanations determine the outcomes of cooperative learning (Neber, 1998; Webb, 1988), only a few investigations gathered limited data on activities when students work cooperatively with peers. For this reason, outcomes in most studies could not be theoretically explained. This signifies a need for more theory-based investigations in this field of gifted education research. Many possible strengths of cooperative learning remained unexplored, such as cognitive effects like the transfer of knowledge and self-regulatory strategies as well as motivational effects like increased interest in the topics studied, developmental effects on self-system variables such as self-efficacy and social effects like social skills and the development of leadership. Data on such aspects are required for summative evaluations of instructional interventions using cooperative learning.

Furthermore, it remains unclear whether the studies with high-ability students

really implemented cooperative learning or only used this label. Only a few studies seem to have explicitly established goal-interdependency among the members of the groups, for example, by using existing procedures like Jigsaw or STAD. In most investigations, this defining feature of cooperative learning was not controlled and no clearly defined model of cooperative learning was used in designing the experiments.

Concerning the participants of the experiments, there was often no clear distinction between gifted and high-achieving students. Therefore, almost no data are available on the effects of cooperative learning on more subgroups of gifted learners. Who profits most from cooperation—gifted high achievers, gifted low achievers or even non-gifted overachievers? Answers to these questions remain open.

A final remark on the deficit of current studies on cooperative learning with high-ability groups of students should be mentioned. Almost all of the analysed studies applied cooperative learning for attaining a narrow range of low-level learning goals. Learning tasks, which represent one of the most important components of learning environments, were not systematically varied in these investigations (Doyle, 1988). Therefore, information is missing regarding which kinds of tasks should be handled cooperatively. With regard to studies on project-oriented and problem-based instruction (Krajcik *et al.*, 1998) and learning by discovery (Horz *et al.*, 2001; Neber, 1999), it might be hypothesised that larger positive effects of cooperative learning might be expected with much more cognitively complex tasks than those used in the studies reviewed. Cooperative learning with high-ability learners should be investigated in the context of such constructivist approaches of instruction, which, as in the case of learning by discovery, proved to be the most adequate methods for gifted and high-potential learners (Brown & Palincsar, 1989; Corno & Snow, 1985; Heller & Hany, 1996; Inagaki & Hatano, 1988; Neber, 1997; Urban & Joswig, 1998). Studies on cooperative learning with high-ability learners, therefore, should not aim to get answers to yes-or-no questions, but should provide more differentiated answers on when, how and in which instructional sequences cooperative learning should be used with gifted and/or high-achieving learners.

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